THE INDUSTRY GOVERNMENT RELATIONS GROUP

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New Brunswick Mining Industry

A Study for

The Department of Natural Resources and Energy

Final Report

prepared by

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Executive Summary

Introduction and objective

The Government of New Brunswick, Department of Natural Resources and Energy, has become concerned about the marked decline in mineral exploration and mineral production which has taken place in recent years. In undertaking this study it was the Province's intention to identify any and all steps it could take to reverse this trend.

> *The purpose of the study is to prepare a report for government containing a strategy and recommendations for improving and expanding the viability of New Brunswick's Mining (Mineral) Industry into the next millennium. The report should also contain specific recommendations on the role of government including the balance necessary between economic and public interests.*

The Government identified key issues to be studied in several categories:

- Declining Mineral Exploration and Declining Reserves;
- Research and Development into Mineral Technology;
- Government Legislation; Mineral and Fiscal Policy;
- Declining Access to Land Base; and
- Other Considerations.

During the course of this study the Steering Committee defined an objective for the Province:

> ***Objective:*** *Maintain or increase current value of production ($860 million plus), taxes, royalties and employment from the mining industry.*

In the face of projected closure of the Brunswick mine within ten years and the absence of known resources of equal quality, the government's objective is indeed a challenging one. We feel that the suggested objective can be met, given the right mixture of favourable government policies, entrepreneurial effort, and luck. We therefore endorse it, and have built our study around recommendations which we hope will assist government to do its part.

The Report is in three parts. Part I (Chapters 1 and 2) attempts to set the stage by introducing the subject and providing basic information on New Brunswick's mineral endowment. Part II (Chapters 3 to 7) presents extensive analyses of the issues posed in the Terms of Reference. Part III consists of one chapter, Chapter 8, which presents a strategic framework or context in which the reader can easily grasp the totality of recommendations and their relationship to the objective.

Methodology

Our methodology was of two general kinds. First, we analysed quantitative and qualitative data, wherever available and relevant, to provide an objective perspective on the issues. Secondly, we obtained comments and suggestions from a large number of individuals who are knowledgeable about the issues and/or familiar with New Brunswick's resource base.

In all, over 90 individuals have been involved in these consultations. Respondents were drawn from a wide range of private-sector organizations (from prospectors and junior companies through major corporations), from academia, and from government (New Brunswick, other provinces and territories, and federal).

Our findings: a strategic framework for government action

The study's outcome is best summarized by reference to the strategic framework found in Chapter 8. It is intended to outline the conditions that must be met if the government's objective is to be realized. The necessary conditions will only be fulfilled if industry and government take concrete actions. The framework shows how each of our recommendations will contribute to the necessary actions in support of the objective.

Conditions for success

To achieve the suggested objective, some or all of the following broad conditions must be met:

- One or more large viable base metal discoveries must be made (or an equivalent number of smaller deposits).

- Alternatively, a processing technology breakthrough may make known base metal deposits viable, but the probability of this is unknown at present.
- Proposed technical modifications to the Belledune smelter must be successful and profitable (or a new source of conventional feed must be found).
- Favourable gold showings recently found in southern New Brunswick may result in the development of one or more viable precious metals mines.
- The pace of industrial mineral development must be stepped up.

All of these depend on human effort. For example, new discoveries will not occur unless prospectors, juniors and producers continue and increase their exploration effort. Industrial mineral deposits will not be developed unless entrepreneurs are enabled to make the necessary technical and marketing studies. Technological advances will not be made, or applied to New Brunswick problems, unless scientists and engineers direct their work to relevant areas.

A strategic role for government

Government cannot legislate these actions in the mining industry. But it has a number of levers that can influence private-sector behaviour. It can encourage desired actions by providing incentives and discourage unwanted actions by taxing them or regulating under the threat of sanctions.

Our recommendations are designed to assist the government to push and pull at the mining "system" in order to induce the appropriate actions and thereby improve the chances of meeting the defined objective. Taken together, these recommendations constitute a strategy that the government can implement in working towards the objective of maintaining or increasing the current level of activity in the sector.

The strategy is shown in schematic form in Figure 1, next page. Three pillars of private-sector activity support the objective: exploration and development; industrial minerals; and metal mining, smelting and processing. Around these pillars are grouped the 15 policy fields through which the government can influence the amount or quality of industry activity. Each arrow represents one or more recommendations and is labelled with the recommendation number(s). Each originates in the relevant policy field (section of the report) and is linked to the pillar(s) of

private-sector activity it influences (recommendations 7.3 and 7.4 apply to all pillars, but are not graphically linked to metals and industrial minerals to avoid complexity).

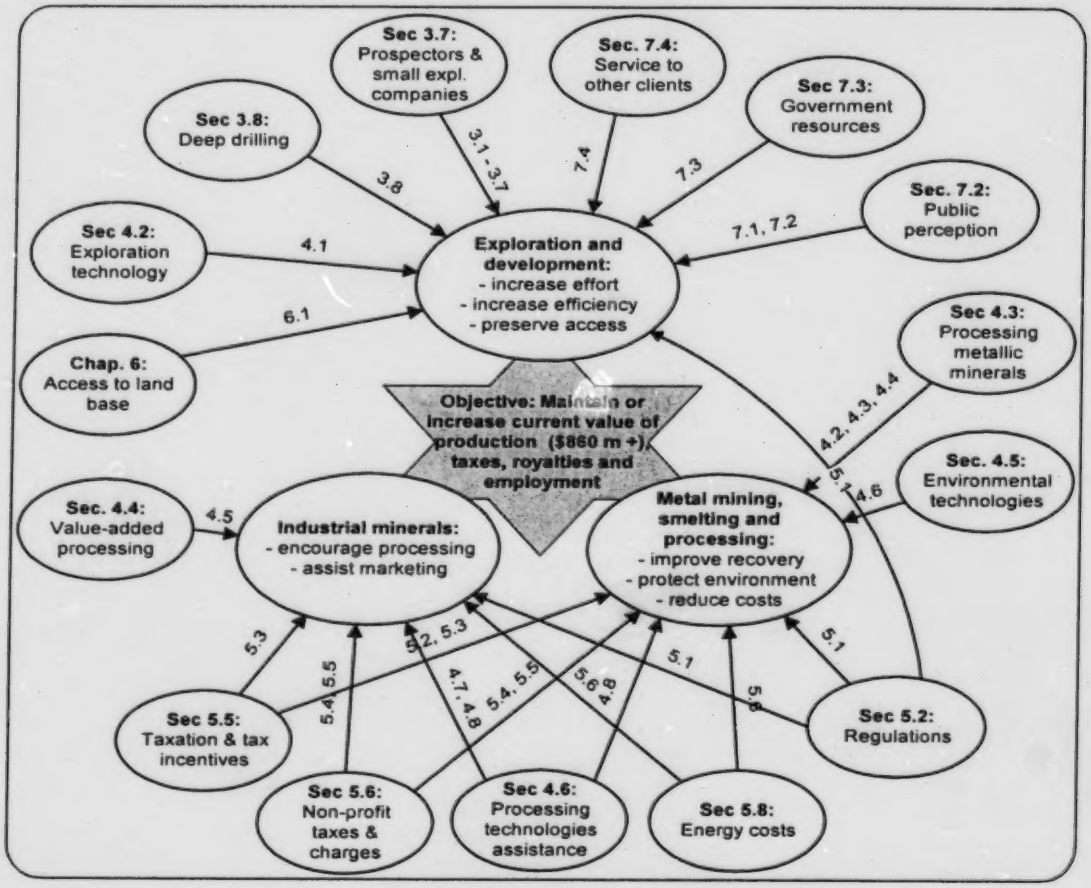


Figure 1: Strategic framework for government action

Elements of a strategy

Our recommendations relate to two types of government policy. ***Sectoral policies*** are directed exclusively at the exploration and mining industries. ***Framework policies*** apply more broadly, covering several sectors or the whole economy. They constitute an important part of the overall

investment climate. Examples of framework policies include income tax, government charges and levies, and environmental regulation. By definition, all three of the mineral industry pillars are affected by framework policies, whereas sectoral policies may be specific to one or another pillar.

Here is a brief resumé of our recommendations in relation to policies as they apply to the three industry pillars. Note that as some recommendations apply to two or more pillars (particularly in the case of framework policies) there will be some repetition. Each recommendation is numbered according to the chapter in which it is found, and sequentially within a chapter. Thus, recommendation 3.1 is the first recommendation in Chapter 3. The full text of all recommendations is appended to this Executive Summary.

Exploration and development can be strengthened by:

- developing a larger number of active prospectors (recommendation 3.1)
- providing more reports on mineral occurrences by commodity (3.2)
- implementing electronic access to technical data (3.3)
- creating a 25% tax credit against cost of shares to finance exploration in New Brunswick (3.4)
- replacing NBEAP with the above tax credit if successful (3.5)
- rewarding success with tax benefits rather than front end incentives (3.6)
- involving the Premier in future major mining conferences (3.7)
- matching surface drilling expenditures to year 2008, to the limit of government revenue from MMTA (3.8)
- encouraging and assisting private-sector and academic research into novel exploration techniques (4.1)
- organizing a meeting of senior management of DNRE and other relevant departments collectively with industry leaders to review regulatory concerns (5.1)
- preserving land access for exploration and mining (6.1)
- considering, in cooperation with industry, a communications program featuring factual mining industry information (7.1)
- continuing to promote both mining and eco-tourism, where possible combining these interests (7.2)

- preserving and enhancing the financial resources government devotes to mining and minerals (7.3)
- reviewing the legislative mandate and budget of Minerals and Energy Division to finance services rendered to other branches of government (7.4)

The ***metal mining, smelting and processing industry*** can be strengthened by:

- sponsoring a technology seminar on tailings reprocessing (4.2)
- continuing to monitor metallurgical developments of potential application to fine-grained ores (4.3)
- when warranted by new base metal deposits and international conditions, promote research and investment in metallurgical technology (4.4)
- participating in the base metal smelter strategic options process (4.6)
- sponsoring a technology seminar on mineral processing (4.8)
- organizing a meeting of senior management of DNRE and other relevant departments collectively with industry leaders to review regulatory concerns (5.1)
- reviewing the MMTA to make it more competitive with other jurisdictions (5.2)
- reviewing the Capital tax with a view to eliminating it (5.3)
- reviewing provincial non-profit charges and levies (5.4)
- taking a leading role with other jurisdictions to reduce non-profit charges and levies (5.5)
- working in all ways to keep energy costs down (5.6)
- maintaining government resources directed to the mineral sector (7.3, 7.4)

The ***industrial minerals*** sector can be strengthened by:

- adding processing skills to the interdepartmental team promoting industrial minerals (4.5)
- offering unmatched grants to $5,000 under VAMP for preliminary technical studies (4.7)
- sponsoring a technology seminar on mineral processing (4.8)
- organizing a meeting of senior management of DNRE and other relevant departments collectively with industry leaders to review regulatory concerns (5.1)
- reviewing the Capital tax with a view to eliminating it (5.3)
- reviewing provincial non-profit charges and levies (5.4)

- taking a leading role with other jurisdictions to reduce non-profit charges and levies (5.5)
- working in all ways to keep energy costs down (5.6)
- maintaining government resources directed to the mineral sector (7.3, 7.4)

Conclusion

This concludes the summary of our study of the "New Brunswick Mining Industry". We have carried out a detailed analysis of relevant factors. We have made 27 recommendations to the government to strengthen the industry and improve the odds of maintaining mineral-related activity at current levels.

Due to the probabilistic nature of mineral discoveries, we cannot be certain that these actions will achieve the objective. We do believe, however, that together they constitute an effective and prudent strategy which is within the government's capacity to implement.

We are concerned that existing resources devoted to the mineral sector are minimal in comparison with those devoted to other resource sectors within New Brunswick, as well as in comparison with those devoted to minerals by other jurisdictions. Recognizing the government's need to constrain expenditures, we have not suggested expensive new programs. On the other hand, we believe some internal rebalancing in favour of minerals is needed and would be very concerned if resources allocated to minerals were reduced.

List of Recommendations

Chapter 3: Declining Exploration and Reserves

3.1 DNRE should budget at least $300,000 annually for a comprehensive prospector development program. This budget should incorporate a training program, current funds budgeted for promotion as well as for a significant component to promote interest in prospecting in the broadest sense, and, an increased number of MESP grants averaging about $3,000/recipient/year, but with a maximum of $10,000.

A cash award of up to $10,000 should be given to anyone, whether or not a MESP recipient, who discovers a previously unrecorded mineral occurrence that is spatially and geologically distinctive. Details of the overall prospector development program should be resolved in consultation with the NB Prospectors and Developers Association.

3.2 Assign a greater proportion of the existing budget to the generation of reports on occurrences of commodities, both metallic and non metallic. Choose commodity priorities on the basis of perceived potential in the province and market trends. Draw analogies, where conceivably possible, with world scale mines in geological settings such as those of the commodity occurrences in New Brunswick. Make the reports Internet accessible and give search engines a selection of key words that will ensure "hits" by people doing searches for the commodity, associated commodities and all aspects of the geological setting.

3.3 Announce and begin to implement a goal of full electronic access to all technical data in DNRE files, including access to claim maps as well as both filing and access of assessment reports.

3.4 Announce a plan to adopt on a one-year trial basis in 2001 the 25% tax credit, or a variant thereof, as proposed by the New Brunswick Prospectors and Developers Association. The credit against the provincial share of income tax otherwise payable by New Brunswick taxpayers would be 25% of the portion of the purchase price of shares that is used for direct exploration in New Brunswick.

3.5 During the year 2000, the NBEAP program should be retained, but phased out or reduced thereafter, if the tax credit is successful in increasing the level of junior company activity.

3.6 Announce a plan to reward success with future tax benefits rather than get caught up in short term competition with grants and front end incentives for scarce exploration dollars. Under consideration should be stated to be a tax holiday for 10, or more, years. This would be from commencement of production from any mineral deposit not previously mined. The holiday would apply to the provincial share of income tax and to the mining tax collected under the Metallic Minerals Tax Act.

3.7 For maximum impact, encourage the Premier to make these announcements at major mining conferences such as the Prospectors and Developers Association or the Canadian Institute of Mining, Metallurgy and Petroleum.

3.8 The province should seriously consider adopting a program under which it would match the surface drilling expenditures of any explorer (except for delineation of a deposit previously tested by more than 10 holes) between now and 2008 to the limit of government revenue for the previous year under the Metallic Minerals Tax Act (MMTA). This program could replace NBEAP.

Chapter 4: Research and development into mineral technologies

4.1 Under existing R&D support programs, the Province should assign some priority to assisting private-sector and academic research into exploration techniques of potential application to New Brunswick conditions. In particular, the Department of Natural Resources and Energy should sponsor a one-to-two-day seminar for academics, mineral professionals and technology firms to explore new approaches to mineral exploration techniques.

4.2 The Province should consider sponsoring a one- to two-day seminar for operators, academics (including economists) and technology firms to interest them in exploring ways

to capture environmental benefits and make the reprocessing of tailings from a wider area more economic.

4.3 The Province should continue its practice of reviewing metallurgical developments of potential application to New Brunswick fine-grained ores approximately every five years.

4.4 If any process identified in such a study seems to hold particular promise under the conditions applying at that time (e.g. existence of one or more substantial new base metal deposits and international conditions warranting a new metallurgical plant), the Province may wish to become actively involved with industry and the federal government in promoting such investment.

4.5 The Department of Natural Resources and Energy should attempt to strengthen its multi-agency team of officials charged with identifying potential markets and value-added processing opportunities for industrial minerals by replacing needed processing expertise.

4.6 The Province should participate in the base metal smelter strategic options process in order to assess needed technologies.

4.7 Revise the conditions of the Value Added Mineral Processing program in order to offer unmatched grants of up to $5,000 to permit preliminary investigation of new concepts and technology. Dedicate a portion of the annual funding (say, 20%) to this purpose.

4.8 Publicize the Province's needs for technological answers to mineral processing problems and challenge the academic and scientific communities to come forward with ideas. A technical seminar similar to others proposed in recommendations 4.1 and 4.2 could be considered.

Chapter 5: Government legislation; mineral and fiscal policy

5.1 Senior management of DNRE and other affected departments should meet with industry leaders to discuss any concerns with the regulatory climate in New Brunswick.

5.2 New Brunswick should review the *Metallic Minerals Tax Act* with a view to eliminating the royalty provision and making the overall tax burden more competitive with other provinces.

5.3 New Brunswick should review the Capital Tax with a view to eliminating it when the financial position of the Province permits.

5.4 As deficits are eliminated, the Province of New Brunswick should review its own mandated non-profit charges, fees, levies and taxes to ensure that they do not constitute a barrier to mining investment or a threat to the continued productive life of existing mines.

5.5 The Minister of Natural Resources and Energy take a leading role within the network of federal and provincial mines ministers to ensure that this issue is resolved. The federal-provincial network of ministers of agriculture, industry and finance should also be involved.

5.6 The Government should work to ensure that industry energy costs are minimized by: encouraging energy conservation; maintaining its support of electricity deregulation and competition; ensuring that its regulatory structure in relation to natural gas transmission favours availability of gas for New Brunswick industrial users; and closely monitoring international negotiations under the Climate Change Convention to ensure that Canada does not offer unrealistic commitments.

Chapter 6: Declining access to land base

6.1 Preserve access for exploration and mining to the extent possible by: ensuring that mineral exploration and mining interests are given full weight in all decisions that affect land access; avoiding setting aside areas containing recognized mineral potential; where areas are to be set aside, ensuring that a reasonable period is given, and significant efforts made, to assess mineral potential; wherever consistent with valid conservation objectives, preserve the possibility of economic benefits by favouring multiple land use policies.

Chapter 7: Other considerations

7.1 The government should consider a low-key program of factual information concerning especially the industry's economic contribution, its improving environmental record and its safety record. The information program should be carried out in cooperation with organizations representing the New Brunswick exploration and mining industries. The proposed information program should document the steps that are being taken by industry and the Government to reduce the industry's environmental impact and improve worker safety in New Brunswick. Messengers for a communications program should be selected from professionals such as geologists and engineers, whether employed by industry or government.

7.2 We unequivocally recommend that the Province continue to promote both its mineral industry and eco-tourism. The Government could consider making positive evidence available to eco-tourists that the New Brunswick resource industries are making strides in protecting the environment. Among other methods, this could take the form of designating model sites and promoting visits to them by eco-tourists, who could see first-hand the latest and best technology at work.

7.3 The Government should preserve, and enhance to the extent possible, the financial resources devoted to mining and minerals within DNRE.

7.4 The government should review the legislative mandate and budget of the Minerals and Energy Division with a view to ensuring that necessary services and expertise can be rendered to other branches of government, outside agencies and the public without interfering with the primary mandate, that of managing the mineral and energy resources of the Province.

Contents

		Page
Executive Summary		i
	Part I: Setting the stage	
1.	Introduction	1-1
2.	Resource Inventory	2-1
	2.1 Metallic mineral deposits	2-1
	2.2 Non-metallic mineral deposits	2-4
	Part II: Key Issues	
3.	Declining Exploration and Reserves	3-1
	3.1 Introduction	3-1
	3.2 The discovery record	3-2
	3.3 Comparison with the discovery record for Canada	3-5
	3.4 Intensity of exploration	3-6
	3.5 The exploration decline and its causes in perspective	3-9
	3.6 Resource potential	3-10
	3.7 Prospectors and small exploration companies	3-12
	3.8 Deep drilling	3-20
	3.9 Geoscience data base, expert advice to industry, and promotion	3-25
	3.10 A regional perspective on policy suggestions	3-28
4.	Research and Development into Mineral Technologies	4-1
	4.1 Introduction: the needs	4-1
	4.2 Exploration technology	4-2
	4.3 Processing metallic minerals	4-4
	4.4 Industrial minerals: value-added processing opportunities	4-11
	4.5 Environmental technologies	4-12
	4.6 Processing technologies assistance	4-17

Contents, continued **Page**

5. Government Legislation; Mineral and Fiscal Policy 5-1
5.1 Introduction 5-1
5.2 Regulations 5-2
5.3 Exploration incentives 5-9
5.4 Processing technology incentives 5-18
5.5 Taxation and tax incentives 5-19
5.6 Non-profit taxes, levies and charges 5-28
5.7 Reclamation securities 5-32
5.8 Energy costs 5-43

6. Declining Access to Land Base 6-1
6.1 Introduction 6-1
6.2 Present status in New Brunswick 6-2
6.3 Comparison with other jurisdictions 6-4
6.4 Perceived impact of a protected areas strategy 6-5
6.5 Land tenure considerations 6-6
6.6 Policy implications 6-6

7. Other Considerations 7-1
7.1 Introduction 7-1
7.2 Public perception of mining 7-1
7.3 Government resources directed to mineral sector 7-9
7.4 Minerals and Energy Division in the service of other clients 7-13
7.5 Factors affecting mineral exploration: commodity price 7-16
7.6 New Brunswick mineral potential 7-23
7.7 Strategies for undeveloped deposits 7-23
7.8 Lack of success in finding major mineral deposit 7-24
7.9 Industrial minerals: a question of focus 7-24

Contents, continued **Page**

Part III Strategic framework

8. Strategic framework for government action 8-1
8.1 Introduction 8-1
8.2 The objective 8-1
8.3 Conditions for success 8-2
8.4 Strategic role for government 8-2
8.5 Elements of a strategy 8-4
8.6 Conclusion 8-6

Appendixes

Appendix A: Exploration Incentives in Canada A-1
Appendix B: Public Perception – Detailed Findings A-11
Appendix C: Exploration-Price Relationship A-28
Appendix D: Comments and Suggestions Received A-37
Appendix E: Persons Consulted A-93

Tables

Table 3.1: Exploration and deposit appraisal expenditures in New Brunswick 3-4
Table 3.2: Surface exploration and deposit appraisal drilling 3-6
Table 3.3: Surface exploration drilling in New Brunswick 3-20
Table 3.4: Noranda surface drill holes in N.B. categorized by depth 3-21
Table 5.1: Costs of mineral-related incentive programs 5-10
Table 5.2: Exploration incentive programs in perspective 5-10
Table 5.3: Summary of mineral exploration incentive programs 5.13
Table 5.4: Summary of other mineral industry incentive programs 5-17
Table 5.5: Average effective tax rates for base metal operations in different jurisdictions 5-24
Table 5.6: Energy demand by sectors of the Canadian economy 5-44
Table 6.1: Areas not available for claim staking, or subject to restrictions 6-3
Table 6.2: Areas closed to mineral activity in Sweden 6-5
Table 7.1: Design parameters of various opinion surveys 7-3

Contents, continued **Page**

Table 7.2: Geoscience resources compared across jurisdictions 7-11
Table 7.3: Summary of exploration vs price correlation coefficients 7-20
Table C-1: Annual average mineral commodity prices (current dollars) A-30
Table C-2: Annual average mineral commodity prices (constant dollars) A-31
Table C-3: Exploration expenditures, excluding overhead expenses A-34
Table C-4: Exploration expenditures, including overhead expenses A-35

Figures

Figure 1: Strategic framework for government action iv
Figure 2.1: Competitive position of New Brunswick zinc mines 2-2
Figure 3.1: Canada, Total Exploration Expenditures Per Hectare, by Province and Territory, 1995 and 1996 3-7
Figure 3.2: Canada, General Exploration Expenditures Per Hectare of Claims in Good Standing, , by Province and Territory, 1995 and 1996 3-7
Figure 3.3: Canada, Total Exploration Expenditures Per Hectare, by Province and Territory, 1996 and 1997 3-8
Figure 3.4: Canada, General Exploration Expenditures Per Hectare of Claims in Good Standing, , by Provinceand Territory, 1996 and 1997 3-8
Figure 6.1: Options for N.B. protected areas 6-8
Figure 8.1: Strategic framework for government action 8-3
Figure C-1 (a) and (b) Copper prices A-28
Figure C-2 (a) and (b) Gold prices A-28
Figure C-3 (a) and (b) Lead prices A-28
Figure C-4 (a) and (b) Silver prices A-29
Figure C-5 (a) and (b) Zinc prices A-29
Figure C-6 (a) and (b) Potash prices A-29
Figure C-7: Exploration expenditures (Excluding overhead, current dollars) A-32
Figure C-8: Exploration expenditures (Including overhead, current dollars) A-32
Figure C-9: Exploration expenditures (Excluding overhead, constant dollars) A-33
Figure C-10: Exploration expenditures (Including overhead, constant dollars) A-33
Figure C-11: Exploration vs zinc price A-36
Figure C-12: Exploration vs silver price A-36

1. Introduction

This study was undertaken at the request of a Government of New Brunswick Steering Committee, consisting of members of the following departments and agencies: Natural Resources and Energy; Economic Development, Tourism and Culture; Regional Development Corporation; and Northern Development. Its purpose was to assess the decline in mineral exploration and mineral production which has taken place in recent years. This phenomenon is not confined to New Brunswick. However, it has particular urgency for the Province in that its major zinc producer, the Brunswick Mine, is facing progressive depletion of its reserves and may face closure within ten years. It is the Province's intention to identify any and all steps it could take to reverse this trend, and during the course of the study the Steering Committee defined a specific objective for the Province. The Study's Terms of Reference state the problem as follows:

> *The purpose of the study is to prepare a report for government containing a strategy and recommendations for improving and expanding the viability of New Brunswick's Mining (Mineral) Industry into the next millennium. The report should also contain specific recommendations on the role of government including the balance necessary between economic and public interests.*
>
> *In New Brunswick, the exploration industry invests $7-15 million/year in search of new mineral deposits. The province spends another $2 million/year to create and manage a geoscience knowledge base. During the last ten years, exploration by industry has steadily decreased from a high of $17.7 million in 1988 to a low of $7.7 million in 1998. The declining trend is alarming as it severely affects the future mining industry of the province.*
>
> *Government has identified the following four key issues:*
>
> 1. *Declining Mineral Exploration and Declining Reserves;*
> 2. *Research and Development into Mineral Technology;*
> 3. *Government Legislation; Mineral and Fiscal Policy; and*
> 4. *Declining Access to Land Base.*

The viability of the New Brunswick Mining Industry could be improved by addressing the above four issues in particular and any other issues, in general. Each issue should be addressed in depth in order to come up with the recommendations to the government.

The authors, both of whom have extensive experience in mineral policy issues, undertook to make the study and to report their findings to the Government. This document is the result.

Our methodology was of two general kinds. First, we analysed quantitative and qualitative data, wherever available and relevant, to provide an objective perspective on the issues. Secondly, we obtained comments and suggestions from a large number of individuals who are knowledgeable about the issues and/or familiar with New Brunswick's resource base. This material was extracted from numerous interviews as well as from written communications sent to us in response to a questionnaire. In all, over 90 individuals have been involved in these consultations. Respondents were drawn from a wide range of private-sector organizations (from prospectors and junior companies through major corporations), from academia, and from government (New Brunswick, other provinces and territories, and federal).

Recognizing both the great quantity and the intrinsic value of the comments and suggestions received, we decided to briefly summarize the main themes arising from respondents' comments in the body of the report and place a transcript in an appendix. It was felt that this arrangement would keep the main report to a readable length while offering the government an opportunity to review the comments in original (sometimes lightly paraphrased) form. We have not attempted to evaluate the accuracy of any comment, nor are we in a position to offer a blanket endorsement of them. In some cases, the comments will provide useful insights into the reasons for our recommendations. In others, where the comments may be based on a misunderstanding of the government's policies or programs, they show the need for better 2-way communication.

The Report is in three parts. Part I (Chapters 1 and 2) attempts to set the stage by introducing the subject and providing basic information on New Brunswick's mineral endowment. Part II (Chapters 3 to 7) presents extensive analyses of the four key issues and other considerations mentioned in the Terms of Reference. Part III consists of one chapter, Chapter 8, which draws together the numerous recommendations into a strategic framework. Supplementary material is to be found in five appendixes.

2. Resource Inventory

2.1 Metallic mineral deposits

Ore reserves are tonnes of material that may be produced under current economic conditions and with present technology. Resources are geologically outlined in whole or in part, but will not necessarily support economic production at the present time.

At current prices, the Brunswick mine is the only economically viable metal producer and the only metallic deposit which has ore reserves. Proven reserves are reported in the Noranda Inc. 1998 Annual Report as: proven: 33,961,000 tonnes averaging 0.39% copper, 8.66% zinc, 3.42% lead and 3.04 ounces of silver per tonne; probable: 6,807,000 tonnes averaging 0.27% copper, 8.10% zinc, 3.39 % lead and 2.81 ounces of silver per tonne. At the end of 1994, the proven ore reserve was: 55,237,000 tonnes averaging 0.3% copper, 9.0% zinc, 3.6% lead and 3.25 ounces of silver per tonne. Annual production is in the order of 3,300,000 tonnes per year.

In the Bathurst camp, only the Half Mile Lake deposit has a resource quality as good as Brunswick and the apparent potential for proving sufficient reserves to warrant investment in mine development at current metal prices. Mineral rights are held by Noranda. Their 1999 exploration budget was increased during the year from $4.5 million to approximately $7 million for the purpose of determining economic potential of the Brunswick-quality portion of the deposit, the top of which lies 500 metres below surface. At least 11 holes are being drilled in the year to a depth of more than 1,200 metres. As a consequence of Noranda's budget increase induced by hopes for Half Mile Lake, the previously cited forecast of $7.5 million as total exploration spending in the province during 1999 will no doubt prove to be low.

The resource quality position of any deposit and mine changes over time relative to the other deposits in the world because of the opening of new mines with different cost structures, changes in metal prices and the increase of costs at aging mines. Figure 2.1 shows that Brunswick has remained in the median position relative to other zinc mines of the world (117 in 1997) from 1982 through 1997, albeit with significant swings from year to year. The trend line slope is suggestive of the mine becoming more competitive since 1985.

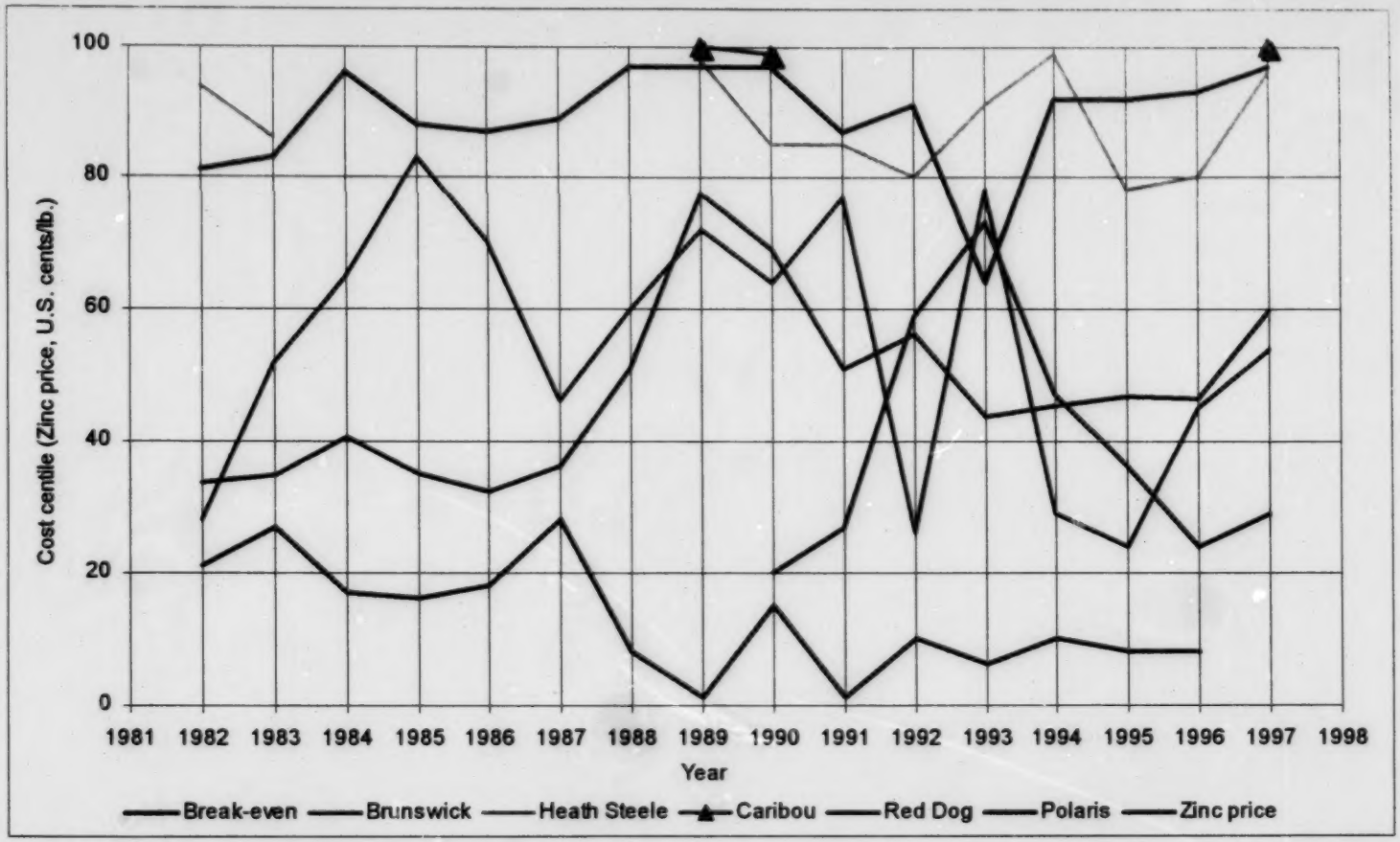


Figure 2.1 Competitive position of New Brunswick zinc mines

Notes: Competitive position from 1982 to 1997 of world's base metal mines in production, based on 117 mines in 1997 (composite costing – ranked on 1997). "Cost centile" score indicates the percentage of world production that has operating costs equal to or less than the designated mine. Score of 100 is the least competitive and 0 the most competitive. Caribou and Heath Steele are shown only for years in which they operated.

Source: Noranda Mines Inc., based on Brook Hunt data.

The resource quality at Caribou (Breakwater Resources Ltd.), an off-and-on producer, and Heath Steele (Noranda Inc.), which was permanently closed in late 1999, is low as signified by their uncompetitive position and proximity to the break-even line. Other known base metal deposits in the Bathurst camp are even less viable because of insufficient proven reserves, low recoverable metal content or both.

The Mount Pleasant tungsten-molybdenum-bismuth and tin-indium deposits in the southwest of the province are large by international standards and contain the biggest undeveloped resource of indium in the world. In 1983, Billiton commenced production of tungsten and molybdenum concentrates from a mine and mill costing some $150 million, only to see viability extinguished within less than two years by a collapse of metal prices. The mine remains on a care and maintenance basis. More than $15 million has been spent by a succession of subsequent investors to establish viability of the tin-indium deposits. Commercial success depends on further process R & D and/or a real increase in the prices of constituent metals.

The Lake George antimony mine is another which remains on a care and maintenance basis awaiting a revival of metal prices. It was an intermittent producer from the 1800's until the most recent closure in 1996. The resource is of good quality compared to that of most antimony mines. Nevertheless, the grade, depth and small ore reserve (proven, probable and possible total 262,000 tonnes averaging 3.45% antimony) will require a significant and, no doubt, sustained increase in the normally volatile price of antimony. In addition, sulphide antimony ore concentrate is becoming less marketable as more mines now remove the sulphur and produce end products, the fire retardant, antimony trioxide, and to a lesser extent, antimony metal. A proposal to produce antimony trioxide by a roasting process at the Lake George mine was blocked by local environmental opposition.

While the Province has little history of precious metals mining, recent favourable showings of gold in southwestern New Brunswick have raised hopes of a brighter future. Over 500 claims have been registered in recent months near Rollingdam. Taken together with an earlier showing in the Poplar Mountain area, these are early indications that the properties could develop into substantial mining operations at some time in the future. The geological environments seem to be similar to the "Tintina Belt" that straddles the Yukon/Alaska border, a region that has attracted much exploration interest.

2.2 Nonmetallic mineral deposits

The potash resource in the Sussex region is of high quality and, because of location near the deep water port of Saint John, can be competitively delivered to world markets. Reserves are not published but are reported by PCS to be sufficient for at least 23 years at current rates of production (785,000 tonnes of product in 1998). Water inflow in 1997 at the Cassidy Lake mine unfortunately eliminated a reserve which otherwise would have continued for many years to provide employment and some million tonnes of product annually. The current owner, PCS, is considering use of the Cassidy Lake mill to allow doubling of capacity at the Sussex mine, providing an apparently minor water inflow can be controlled. The third potash deposit in the Sussex area (Millstream) is expected to remain a resource until there is a real increase in the price of potash or the energy cost makes evaporation competitive, and, if magnesium is also to be recovered, electricity intensive processing is competitive. The other most prospective targets for occurrence of potash were drill tested by government in the 1970s, but only common salt (NaCl) and Glauber salt ($Na_2Ca(SO_4)_2$) were encountered. Both of the latter are resources which are very unlikely to be competitively supplied to existing markets, even though quality may be comparable.

Limestone, gypsum, anhydrite, silica, diatomite, peat and dimension stone and structural materials are resources which, except for peat, are underdeveloped in the province relative to their potential. As markets grow in the region and alternative sources are sequestered by urbanization, opportunities will occur. These resources, in some cases, can be processed into high value products rather than just shipped in bulk. However, the R & D and marketing factors are crucial to the commercialization in such cases.

3. Declining Exploration and Reserves

3.1 Introduction

The Terms of Reference for our study express the Government's concern as follows:

> *In New Brunswick, the exploration industry invests $7-15 million/year in search of new mineral deposits. The province spends another $2 million/year to create and manage a geoscience knowledge base. During the last ten years, exploration by industry has steadily decreased from a high of $17.7 million in 1988 to a low of $7.7 million in 1998. The declining trend is alarming as it severely affects the future mining industry of the province.*

3.1.1 Current exploration trends

According to a federal-provincial survey, some $7.5 million is forecast to be spent in New Brunswick during 1999 for exploration and mineral deposit appraisal. This amount is less than half the $14.8 million spent in 1996. On a constant dollar basis, this will be the lowest since the 1958-65 and 1971-73 periods (see Table 3.1). Mineral claims in good standing at the end of 1999 were 14,884, down 17% from the end of 1998 and at a 25-year low. Claims recorded in 1999, at 1,771, represented a 29% decline in this leading indicator from 1998.

Although the reduction of exploration activity in the province is disturbing, New Brunswick is not alone. Worldwide spending allocated to the search for nonferrous metals declined by 31% in 1998 and a further 23% in 1999 (Mining Engineering, December 1999, p.8). The plight of the Val d'Or district in Quebec, despite lucrative provincial exploration incentives, and of British Columbia's mining industry, respectively, were described in recent Globe and Mail (28/12/99) and National Post articles (26/12/99).

3.1.2 The challenge for government

Perception of the probability for New Brunswick to yield an economic discovery relative to the probability elsewhere, whether a correct perception or not, determines where investors place their bets. Fewer outside companies are betting on the province.

There will be other surges of exploration spending as there have been in the past. These will be induced by metal price increases or discoveries which capture the imagination of speculative investors and mining companies. The challenge, in the meantime, is to prepare to catch, fully capitalize on, or even start, the next wave, by:

1. stimulating the discovery of an "inventory" of new prospects;
2. effectively promoting credible analogies between New Brunswick's various geological environments and such rock associations with world class mines elsewhere;
3. maintaining competitive and fair legislation.

The goal must be to create a perception of economic potential in the minds of numerous prospective investors. Without enthusiasm and success in creating this perception, New Brunswick has a strong chance of becoming a mining backwater rather than a beneficiary, much less, the spark which ignites the next major wave of investment. Given the investment friendly climate of many hitherto uncompetitive resource rich countries, the challenge is considerable.

3.2 The discovery record

From 1952 through 1957, in the order of 40 metallic mineral deposit discoveries were made in New Brunswick at a cost of some $18.5 million or $119.4 million in 1998 dollars ($103 million in 1990 dollars), undoubtedly a success rate and cost per discovery that is without precedent. Of the 18 most significant, two (Brunswick #6 and #12) since 1964 have sustained an economically viable operation which was the world's largest zinc mine and now ranks second after the Red Dog mine in Alaska, two (Heath Steele and Wedge) sustained marginal to viable operations, one (Nigadoo) operated for two periods totalling almost 8 years without paying more than interest on the $10 million borrowed to bring it to production and five others (Caribou, Restigouche, Murray, Captain and Mt. Pleasant) have records of intermittent operation totalling 1 to 3 years.

The initial discovery of Brunswick #6 in 1952 resulted from the field work of a University of New Brunswick geology MSc candidate, A. B. (Ben) Baldwin, and his professor, G. S. MacKenzie. The sulphide phase of a previously mined iron deposit proved to be the economic basis for a new zinc-lead-silver mine rather than the sulphur for which it was initially drilled by a junior mining company listed on the Toronto Stock Exchange. The company was promoted by the renowned M. J. Boylen, and provided summer employment and thesis support to the subsequent Dr. Baldwin.

The unprecedented run of success in such a short time following the Brunswick #6 discovery was, in large part, the consequence of utilizing two newly emergent technologies, namely, soil and stream sediment geochemistry in conjunction with airborne electromagnetic and magnetic surveys. Nevertheless, there is a relatively high population density of base metal deposits in the Bathurst volcanics compared with similar volcanic accumulations elsewhere. One geologist, W. Luff, who has done a compilation reports that "There are nearly 500 million tonnes of massive sulphides in the Bathurst Camp in 45 deposits, with total occurrences of 111."

Since 1957, a search and delineation expenditure of $395 million (1990 dollars) has been made (see Table 3.1). This effort has resulted in many discoveries (25 in the 1968-78 period alone). However, none of the metallic discoveries to date have proven to be economic. This undoubtedly poor record is a consequence of the following:

- little effort in testing for hypothesised deposit types other than those being mined;
- inability to detect deeply buried deposits and insufficient relevant R & D;
- below average quality of majority of known resources/deposits;
- lack of incentive to drill deep holes in the Bathurst camp to find base metal deposits that have a high probability of being marginal even if found at surface;
- a perception that there are few economic metallic mineral deposits to be discovered;
- exploration prioritization based on short term considerations;
- lack of employment continuity in NB after company geologists gain local expertise;
- not enough grass roots prospecting by local residents;
- an unduly long run of bad luck.

Table 3.1: Exploration and deposit appraisal expenditures in New Brunswick
(Millions of Canadian dollars for years 1947-1999, excluding overhead)

YEAR	Current $	1990 $		YEAR	Current $	1990 $
1946	0.00	0		1974	3.80	11.38
1947	0.05	0.40		1975	6.90	18.66
1948	0.01	0.03		1976	10.40	26.16
1949	0.01	0.04		1977	7.30	17.00
1950	0.00	0.01		1978	4.30	9.19
1951	0.09	0.52		1979	4.70	9.21
1952	0.11	0.59		1980	5.20	9.25
1953	2.93	16.53		1981	5.70	9.02
1954	6.06	33.98		1982	6.20	8.85
1955	2.91	16.34		1983	7.70	10.40
1956	3.77	20.74		1984	10.91	14.11
1957	2.69	14.42		1985	12.08	15.04
1958	0.56	2.93		1986	10.77	12.87
1959	0.69	3.53		1987	9.13	10.45
1960	1.78	9.03		1988	13.77	15.16
1961	0.78	3.95		1989	11.19	11.73
1962	0.68	3.36		1990	14.13	14.13
1963	0.72	3.53		1991	13.36	12.66
1964	0.79	3.78		1992	10.09	9.42
1965	1.21	5.68		1993	9.55	8.75
1966	1.82	8.26		1994	8.37	7.65
1967	1.95	8.53		1995	10.49	9.39
1968	2.10	8.84		1996	13.45	11.81
1969	2.30	9.25		1997	12.16	10.55
1970	1.90	7.32		1998	8.79	7.55
1971	1.10	4.12	Forecast 1999		6.84	5.87
1972	0.70	2.50	Subtotal, 1946 - 1959		19.87	110.06
1973	1.30	4.32	Subtotal, 1960 - 1999		255.89	388.73
			Grand Total, 1946 - 1999		275.76	498.79

Notes: 1. 1968-69 & 1979-81 unavailable so above numbers for these years estimated using a straight line joining immediately preceding and following years.

2. Exploration and deposit appraisal expenditures represent all activities on or off the mine site to search for, discover and bring a deposit (that is not being mined and would not be accessed from an existing mine) to the stage of detailed knowledge required for a production decision. Prior to the current decade, these expenditures were for exploration "outside producing properties or properties being readied for production". Thus, although there may have been reporting differences, exploration for deposits that could become mines would not be overstated in either case.

3. Exploration for petroleum and natural gas is excluded.

Sources : Natural Resources Canada, Statistics Canada & NBDNRE files. Based on annual federal-survey of mining and exploration companies.

Exploration for industrial minerals has been sporadic and the expenditure nominal (2-5 percent) compared to that for metals. The greatest expenditure was during the latter half of the 1970s and first half of the 1980s for evaluation of three potash deposits discovered near Sussex by a federal-provincial drill program in the 1970-73 period. Production from one of these commenced in 1983 and continues today. Operations at a second began in1985 and permanently ceased in1997 due to unmanageable water inflow. Mineral rights to both are held by Potash Corporation of Saskatchewan Inc. (PCS) under agreements with the province.

The third potash deposit (Millstream) was explored by BP Resources Canada Ltd. in the 1980s and re-evaluated by IMC Kalium in 1996. Mineral rights reverted to the province in 1997. The main reasons for lack of development are resource complexity and depth (950-1050 m), even though *in situ* geological reserves are estimated at 256 million tonnes averaging 20.6 % K_2O and with which there is an associated magnesium resource estimated at more than one hundred million tonnes.

3.3 Comparison with the discovery record for Canada

In Canada, it costs an estimated average of $67 million (1990 $ throughout paragraph) to find and delineate each economic gold and base metal deposit discovered from 1946 through 1988, based on total reported expenditures of $10.2 billion for the period. The discovery costs "increased from $28 million in the 1946-59 interval to over $100 million in the latest interval, 1980-88" (Mackenzie & Doggett, CRS Perspectives, Number 41, Centre for Resource Studies, Queen's University, November 1992, pp. 14-16).

In New Brunswick, the search and delineation expenditure for the1946-88 period was $389.3 million (1990 $ throughout paragraph) or 3.8% of the Canadian total. If the Canadian average cost of $67 million per economic deposit is applied, this expenditure should have resulted in approximately six economically viable mines. New Brunswick's record is good only if it could be argued that Brunswick #6, Brunswick #12, Heath Steele, Stratmat, Wedge, Nigadoo, Captain, Restigouche, Murray, Mt. Pleasant, Cape Spencer and Caribou mines were all separate and viable, even though only two or three would have met the Mackenzie & Doggett economic viability tests of generating more than $20 million in revenue and providing at least an 8 percent discounted cash flow rate of return.

For the 1980-88 period, the $105.2 million (1990 $ throughout paragraph) spent in the province should have resulted in one mine, based on this being the approximate cost per economic discovery in Canada as a whole for that period. The $109.5 million expenditure from1988 through 1999 should have found another. Will the payoff be either or both the Golden Ridge and Clarence Brook gold discoveries respectively made by prospectors Donald Ward and Reginald Cox in 1997 and 1998? In any case, should these or some other prospect be proven economically viable, it will usher in a wave of exploration by companies new to the province as well as many which had hitherto written off the potential. Such is the nature of the business!

3.4 Intensity of exploration

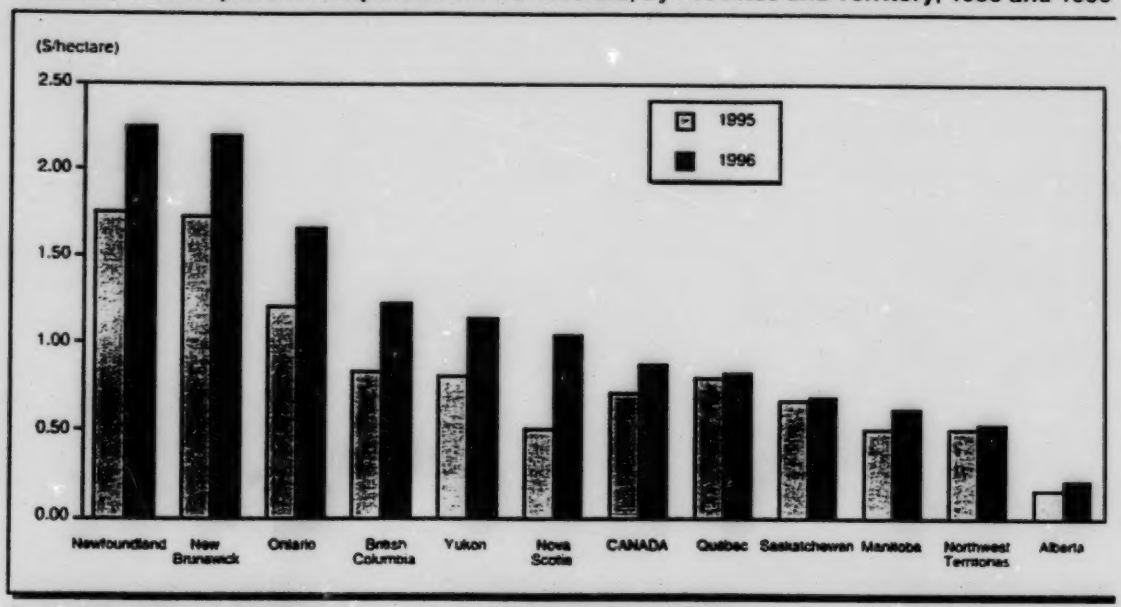
The poor success rate of the past four decades is all the more alarming when one considers that New Brunswick ranks higher than the majority of Canadian provinces and territories with respect to intensity of exploration. Intensity can be expressed as metres drilled from surface per square kilometre of provincial area (Table 3.2), a crucial indicator that is free of inflation.

Table 3.2: Surface exploration and deposit appraisal drilling
(Metres of drilling per square kilometre of provincial area)

Year	NB	NS	NF	QC	ON
1997	0.99	0.51	0.38	0.33	0.73
1996	1.24	0.28	0.64	0.38	0.82
1995	1.03	0.18	0.25	0.34	0.68
1994	0.66	0.10	0.10	0.36	0.54
1993	0.81	0.16	0.08	0.31	0.31
1992	0.88	0.21	0.05	0.29	0.28
1991	0.85	0.35	0.10	0.36	0.34
1990	1.31	0.33	0.20	0.61	0.61
1989	0.58	0.52	0.26	0.54	0.83
1988	1.37	2.15	0.58	1.13	1.55

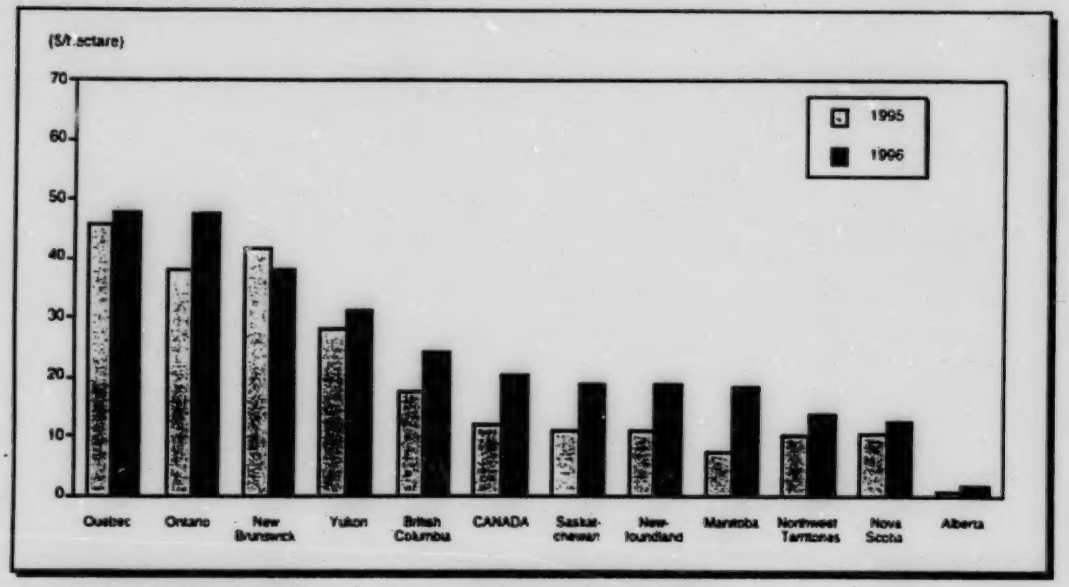
Other good indicators are overall exploration expenditures per hectare of provincial area or of claims in good standing. The figures on the next two pages record the total exploration per hectare in each province or territory (Figures 3.1 and 3.3) and the general exploration expenditures per hectare of claims in good standing (figures 3.2 and 3.4) for the period 1995 to 1997.

Figure 3.1
Canada, Total Exploration Expenditures Per Hectare, by Province and Territory, 1995 and 1996



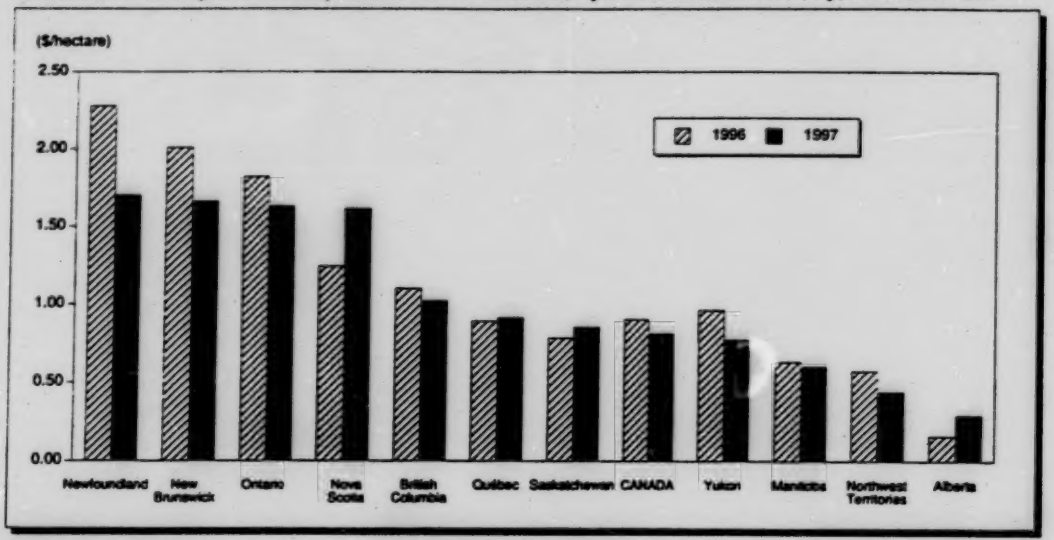
Source: Natural Resources Canada, based on the National Atlas Information Service and the federal-provincial survey of mining and exploration companies.

Figure 3.2
Canada, General Exploration Expenditures Per Hectare of Claims in Good Standing, by Province and Territory, 1995 and 1996



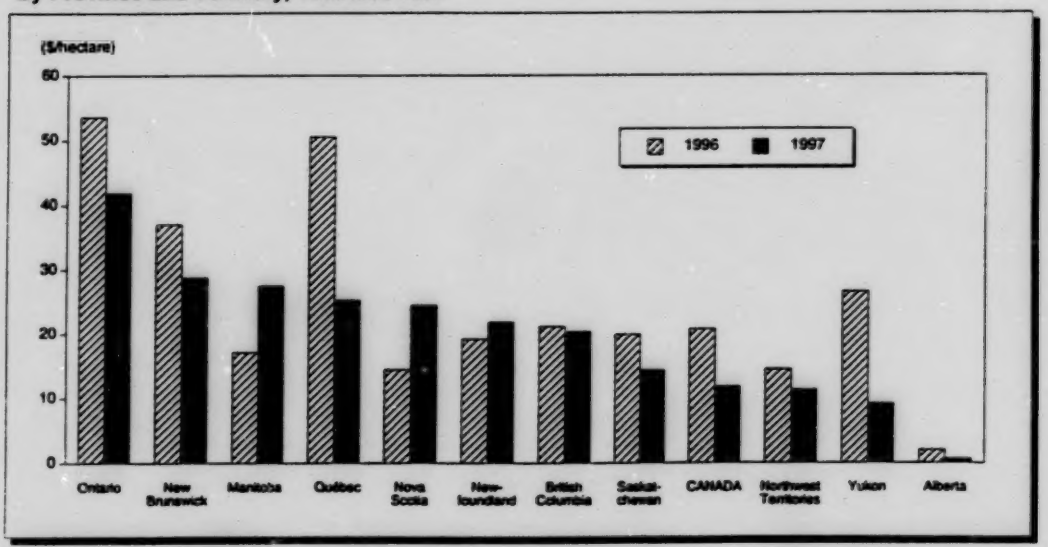
Sources: Federal-provincial survey of mining and exploration companies; provincial/territorial mining recorders offices.
Notes: General, or off-property, exploration excludes mine-site exploration. "Claims in good standing" excludes mining leases.

Figure 3.3
Canada, Total Exploration Expenditures Per Hectare, by Province and Territory, 1996 and 1997



Source: Natural Resources Canada, based on the National Atlas Information Service and the federal-provincial survey of mining and exploration companies.
Note: 1997 exploration expenditures data are preliminary.

Figure 3.4
Canada, General Exploration Expenditures Per Hectare of Claims in Good Standing, by Province and Territory, 1996 and 1997



Sources: Federal-provincial survey of mining and exploration companies; provincial/territorial mining recorders offices.
Notes: General, or off-property, exploration excludes mine-site exploration. "Claims in good standing" excludes mining leases. 1997 data are preliminary.

On the basis of exploration per unit of provincial area, New Brunswick was second only to Newfoundland throughout the period. The Province experienced an increase from 1995 to 1996 followed by a decrease in 1997 to the 1995 level. Per hectare of claims, New Brunswick ranked second in 1995 and 1997, third in 1996.

Nevertheless, in the longer term, the province has seen its share of total Canadian spending fall from over 3 percent before the late 1970s to under 2 percent, first, after the shift in search emphasis from base metals to gold and, subsequently, to diamonds. New Brunswick has no history of viable gold mining nor of diamond mining and is not highly regarded by the mining industry as a "hunting ground" for either (recent gold showings could change that perception).

3.5 The exploration decline and its causes in perspective

From an all time high of $1,350 million (current $ throughout paragraph) in 1988, the annual search and delineation expenditure in Canada declined 72 percent to $385 million in 1992, the lowest since 1978 and, on a constant dollar basis, lower than any of the previous 30 years. By 1996, it had rebounded to $894.8 million, but has since been in decline and is forecast to be $488.6 million in 1999 (Natural Resources Canada, federal-provincial survey). The New Brunswick all time high of $16.5 million (1990) and subsequent low of $10 million (1994), lagged the rest of Canada by two years and the low represented a lesser decline of 39 percent. The rebound to a $14.8 million peak in 1996 (following a government airborne geophysical survey) has been followed by decline. The forecast $7.4 million will represent a 55 percent decline from the all time high versus a forecast decline of 64 percent from the all time high for Canada as a whole.

New Brunswick has attracted primarily those investors seeking base metals. This has a good side in that Noranda Inc. has a very large base metal mining and smelting complex to maintain and accounts for a relatively stable base load of exploration. Annually, this has accounted for $8-11 million of the total and in 1999 will be about $7 million. The bad side is that the other players in the province have become fewer with the decline of base metal exploration in Canada from 1981 through 1986, from 1990 until 1993 and from 1996 to the present. The trend has mirrored base metal current dollar price trends and the long term downward trend in constant dollar prices. At no time has real base metal exploration spending recovered to the 1976 level. The 2-year lag in the province's all time exploration spending peak and subsequent low, relative to Canada's, clearly reflects the large base metal component.

The province received a disproportionately small share of the gold exploration which accounted for over 80 percent of spending in Canada during the 1980s. Discoveries by prospectors Morton Gordon and Harold McNamara near Saint John in the late 1970s and early 1980s failed to excite the wider exploration community, even though one of these gold discoveries briefly achieved production in 1987-88 as the Cape Spencer Mine of Gordex Minerals Limited.

New Brunswick has not received a share of the increased proportion of exploration spending devoted to the search for diamonds. This has accounted for 15-20 percent of Canadian exploration expenditures since 1991 when the Lac de Gras discovery in the Northwest Territories was made. This led to incidental discovery in 1994 of the Voisey's Bay nickel-copper-cobalt deposit in Labrador, potentially the most important metal deposit found in the country for some decades. This discovery also biased exploration budgeting away from the province.

3.6 Resource potential

The assessment of resource potential is an inexact science. The accidental discovery of a major deposit where it was least expected can trigger new thinking and spawn new theories. As well, such a discovery often creates a staking rush and increases exploration activity in the area. In other cases, new theories of ore formation arise from purely academic considerations, as was the case with plate tectonics. These in turn create new prospector interest in areas previously thought unpromising. There are no absolutes: mineral potential is a matter of perception. We record here the perceptions of knowledgeable observers regarding New Brunswick's mineral potential.

3.6.1 Perception of resource potential by industry at large

The fact that New Brunswick has benefited little from the productive surges in Canadian and worldwide exploration during the past two decades might seem surprising given the apparent high ranking of the province's potential by 111 respondents to a recent survey by the Fraser Institute. The respondents represented junior and senior companies accounting for 43 percent of total 1998 exploration spending in Canada. Further detail can be obtained at the Institute's Internet site: http://www.fraserinstitute.ca/.

New Brunswick falls in the middle of the 35 countries ranked according to mineral potential, even though 77 percent of respondents indicated that the "mineral potential encourages or is not a deterrent to exploration". The relative rank of the province was much better with respect to taxation, environmental regulation, regulatory duplication and inconsistencies, land claims uncertainty, protected areas uncertainty, labour regulation, infrastructure, socio-economic agreements, and, uncertainty concerning the administration, interpretation, and enforcement of regulations. Thus, investment decisions are more reflective of the perceived potential relative to other jurisdictions than of absolute potential. Other factors, regardless of how attractive, take second place.

3.6.2 Perception of resource potential by those familiar with New Brunswick

Private sector geologists and companies active in the province, as well as government geologists, gave the following range of questionnaire responses concerning the probability that the Province's mineral potential is sufficient for mining employment to return to the level that existed prior to the mine closures of the past decade:

Private sector

- Only a small minority of private-sector respondents gave a flat "no" or "yes" to this question. Most linked the probability of a major recovery in mining activity to future spending on exploration. A typical response would be that a sustained exploration effort of $10 - $15 million annually has a 50% - 80% probability of returning the Province's mining activity to previous levels.

Public sector

- Government geologists linked future success rates to a variety of factors, including the magnitude of the 'sustained exploration effort, continued strong support from federal and provincial surveys in provision of geoscience data and exploration assistance programs, metal prices, the stock market, geopolitical considerations, the target commodity (e.g., gold, industrial minerals), and so on. Few quantitative estimates were offered, though the exploration expenditure target of $10 - $15 million annual sustained spending found some support.

3.7 Prospectors and small exploration companies

Exploration investment in New Brunswick is constrained by a perception, in particular by outsiders, of comparatively low resource potential. As a result, the province has not benefited significantly from general upswings of exploration investment (see Section 3.6).

Perception depends not only on an awareness of geological similarity with already productive mining camps, but, perhaps more importantly, on the form and source of evidence being such that it fosters an aura of competition to stake and expeditiously test the "best" locations. The awareness can be created by government survey data and models based on analogy. Nevertheless, before committing a meaningful amount of money to an area where no one has yet developed a mine fitting the analogy, mining corporations as well as companies financed only by sale of common shares need news with a more conclusively positive ring than what is usually contained in government reports. Over and over again, it has taken discoveries by curious and entrepreneurial individuals (prospectors) to trigger investment. Voisey's Bay nickel, Lac de Gras diamonds, Brunswick #6 and even the Horne copper mine, on which Noranda Inc. was founded, are but a few examples of finds that attest to the extremely important role that prospectors have played and continue to play.

Discovery of the world class Brunswick deposits as a result of the research and prospecting-like work of a student is perhaps convincing enough as a case for an increased level of public participation in prospecting, whether full time or as a healthy hobby offering a chance of financial gain. Although the other prospecting successes may not have yielded profitable mines as yet, it is worth noting that at least 16 of some 21 metallic or radioactive occurrences found during the 1968-78 period could have been detected by prospectors using simple tools and/or chemical analyses of samples. Even more noteworthy is that 10 were discovered by 6 or 7 avid prospectors.

Since 1978, a handful of prospectors working with very little in the way of financial support and with rudimentary equipment have continued to make discoveries of gold, tungsten, tin, nickel, copper, zinc, lead and other metals. They concentrated their search for those commodities which were high in price at the time and achieved success. The short-lived Cape Spencer gold mine (1987-88) near Saint John was one such success which served as a modest catalyst for outside investment, but had the misfortune of commencing production in the face of unresolved technical problems and a declining gold price.

The recent Golden Ridge and Clarence Brook discoveries also were made by prospectors and optioned to a share-financed junior, Freewest Resources Canada Inc., which has a modest drill program planned. The hope for future growth of New Brunswick's mining industry rests on occurrences like one of these being proven by drilling to be economic or, if not economic, at least being proven to fit a geological model that excites investors.

3.7.1 Participation rate in prospecting

The current participation rate of less than 0.01% of the general public in prospecting is shockingly low. Aside from the economic benefits which would accrue from mining, participation could and should be increased by at least a factor of 10 to contribute to a reduction of health care costs by encouraging more people to adopt a healthier lifestyle. Furthermore, given the past success rate, having 500-800 active prospectors instead of the present 35-50 would be almost certain to benefit the province more than **ANY** other initiative that DNRE could undertake. Recommendations at the end of this section are designed to strengthen the prospecting sector.

The 14,884 mineral claims in effect at the end of 1999 were held by 77 individuals and 53 companies. Of the individuals, some 40 are known to be prospectors because that is the maximum number of applicants in any of the past 7 years for grants under the Mineral Exploration Stimulation Program (MESP). There may be another 10 or 12. The remaining 25 to 27 are company employees, contract claim stakers, consultants and speculators. Even if the entire 77 "hunt" for minerals, it is a far cry from the 64,165 New Brunswickers who bought deer and small game hunting licences last year and the 50,074 who bought resident angling licences for fish other than salmon.

In the 1970s and early 1980s, approximately 300 prospecting licences were issued annually to individuals and companies. Since 1986, they have been issued for a lifetime rather than annually. The total number on issue at the end of 1999 was 1,438, with 55 sold in 1998 and 58 in 1999. The lifetime fee for individuals is $25.00, including 5 sets of claim tags and all taxes. By comparison, a resident deer and small game hunting licence costs $20.00; moose, $50.00; and, angling, except salmon, $10.00. All these other licence fees are for one season or year and are exclusive of a conservation fee of $5.00 and the 15% Harmonized Sales Tax.

In addition to the fact that mining-related economic growth of the Bathurst-Miramichi region was spawned by prospecting-like work and fulfilled by the application of emerging geochemical and geophysical technologies in the 1950s, the experience of Finland during the 1960-1980 period is quite instructive. As is well known, people of the Scandinavian countries have a love of outdoor activities so the government of Finland decided to try to increase the economic benefits beyond regional tourism and health cost savings by offering a small cash reward to those who submitted mineral or rock samples for analysis. In 1979 alone, some 32,000 samples were submitted. Mining was dominated by a state company and Canada's competitive system of claim staking was not available to the public. Nevertheless, seven of the state mining company's ten mines operating at the time were discovered by "layman sample" activity.

3.7.2 Prospecting courses

Commencing in 1980, short prospecting courses were offered at a number of localities throughout the province. These were funded for a time by the federal and provincial governments under a regional development agreement. Teaching was contracted to prospector geologists. Funding eventually became the sole responsibility of the province and the course continued to be offered until funding was withdrawn after 1994. Students apparently contributed to covering of costs by paying a tuition fee of $50.00 during the latter years. In 1996, a prospector-geologist team arranged to offer it through the Community College in St. Andrews, but have not continued as they could not get government support for a program from which graduates are unlikely to find employment.

The prospecting course was very short by any standards and could only be regarded as a sufficient basis to begin fulfilling an interest, with need for ongoing coaching and help by geologists. It was given twice a year in 5 or 6 widely spaced centres in the province, each time over 6 to 10 evenings or 2 weekends. A 1-day field trip also was given. Attendance each time was usually 15-20 and more than this in Bathurst. There always was a waiting list and participants requested more advanced courses. Those who gave the course estimate that about 10% of recipients became reasonably active hobby or part time prospectors.

3.7.3 Mineral Exploration Stimulation Program (MESP)

The MESP program was introduced by DNRE in fiscal year 1988/9 to stimulate exploration by offering grants up to $10,000 to valid New Brunswick prospectors and small exploration companies. Applications are reviewed and awarded by a government-private sector committee. In 1989/90, the grant limit was lowered to $3,000 on the recommendation of the NB Prospectors and Developers Association. In practice, the budget and number of quality applicants has limited the maximum grant to $2,500 since 1993/4 and since 1996/7, it has been no more than $1,800.

The program started with an annual budget of $200,000. From fiscal year 1994/5 through 1998/9, it was $50,000. It is $40,000 this year.

From the introduction of MESP in fiscal 1988/89 through fiscal 1999/2000, 364 grants totalling $684,000 have been awarded by DNRE. The maximum grant in the 1999/2000 fiscal year was $1,500 and the average was $1,200 for 33 recipients. The average and number of recipients were down, respectively, from $1,400 and 35 the previous year.

MESP recipients would initially receive 35%, the next 35% on submission of spending receipts and the final 30% on submitting a brief report. In response to complaints that too much reporting was required, considering the small size of the grant, MESP recipients with a good track record were given the full amount up front in fiscal 1999/2000. A report will be required before they apply for another grant. New recipients without a prospecting record or experience are limited to $500. If the recipient is new to the MESP program, but has been prospecting for some years, the grant would be $1,000. These new recipients would receive funds according to the 35-35-30 formula during their first year under the program.

The MESP Coordinator at DNRE reports that an increase in the maximum grant to $5,000 has been advocated by the NB Prospectors and Developers Association. He suggests that, unless the intended prospecting activity to be supported were to be expanded beyond rudimentary examination and sampling, an increase to $2,000 would probably be adequate to cover necessary expenses and keep genuinely interested prospectors active.

The MESP Coordinator also reports that some prospectors have advocated an additional grant to cover a limited amount of drilling. He believes an additional grant, or grant increment, perhaps

might be helpful if used for trenching or geophysical surveys; however, limited drilling at a stage when little is known about geometry of the mineralization has a good chance of producing results that make it more difficult to attract the interest of junior or senior companies.

The program undoubtedly has become more important to prospectors in recent years because Noranda had an assay laboratory in Bathurst and often would analyse samples at no charge in the hope that they would be given an opportunity to acquire control of promising discoveries. Teck, the other large company which maintained an office in NB for many years, has closed the office and hence is not so accessible to prospectors who relied on them to get samples assayed from time to time. In addition, Stairs Laboratories in Bathurst has closed.

All provinces and territories except Alberta, Prince Edward Island and Ontario have some type of prospector assistance program. Ontario had given assistance, but recently announced that it will cease to do so. The various programs are summarized in Table 5.3. Since these programs primarily foster prospecting by local residents, the provinces are not in competition as they might be in the case of grants to companies. There is a reasonable certainty that the majority of residents will remain in a jurisdiction whereas junior and senior mining companies come and go. Thus, instead of looking at what other provinces are doing to foster prospecting, the stability and long term commitment of people to their home province, the existence of a road and trail network throughout and the competing alternatives for leisure, hobby and part time employment are the important considerations for New Brunswick.

3.7.4 Recent MESP successes

Recent success stories are MESP-assisted gold discoveries by Reg Cox (Clarence Brook, Charlotte County) and Rufus Smith with partner Lorenzo Noel (Clarinda property, Restigouche County). Another gold discovery at Golden Ridge, York County, was made by Don Ward who did not receive a MESP grant. Clarence Brook and Golden Ridge are being explored by Freewest Resources Canada Inc. under option agreements and Clarinda by Slam Exploration Ltd., a Miramichi-based company founded by Michael Taylor who is a prospector-geologist. Without these discoveries by prospectors, it would have been impossible for either company to convince investors to purchase the shares which were sold near the end of 1999 to fund more than $1 million of drilling and other exploration in 2000.

3.7.5 Comments and suggestions received

Several themes emerged from respondents' comments, all in the direction of strengthening prospecting activity and enhancing the effectiveness of MESP. These are paraphrased as follows:

Private sector comments

- Encourage more prospecting by teaching geology in schools, reintroducing prospecting courses, and interesting the general public in eco-prospecting and industrial tourism.
- Increase the size of MESP grants to $5,000 or even $10,000, involving a corresponding increase to the MESP budget (up to $100,000); expand the range of activities covered by MESP.

Comments from government

- Use a variety of innovative means to increase prospecting activity, involving Mining Week, public education, information packages, prospecting courses, site visits, school information programs, adventure/tourism prospecting, etc.; upgrade the knowledge level of practising prospectors, including skills in communications and data presentation.
- Increase the MESP budget to $80,000 and individual grants to $2,000.

3.7.6 Policy implications

Historically, New Brunswick's own people who engage in prospecting have been the most productive resource for finding mineral deposits and attracting mining investment capital. Students, farmers, lumbermen, scalers, butchers, electricians, dentists, geologists, consultants, businessmen, retirees, social assistance recipients and home makers all have been successful prospectors. They are curious, imaginative and observant natural detectives who enjoy the outdoors and probably have a secret desire to make a windfall gain. Although many of the populace fit this description, there are only about 50 active prospectors and no program to inform, motivate and train in order to tap the vast reservoir of potential.

Finding economic mineral deposits is like searching for the proverbial needle in a hay stack. The only difference is that the "needle" or economic deposit is almost always covered by forest and overburden, in many cases consists of minerals different from what the searcher has in mind and,

furthermore, it is wearing a disguise. The long run without an economic discovery is due to too few people looking in different geological environments and not enough drilling.

Although exploration is a "numbers game" as indicated above, oil companies which branched into the search for minerals in the 1970s learned very quickly that spending large amounts relative to their cousins in the mining industry did not assure the predictability of success to which they had become accustomed in searching for oil and gas. Governments, like the mining industry, thus must work very "smart" to assure success. Quite simply, if economic deposits are there to be found and the province maintains a generally competitive and stable business environment, DNRE will have fulfilled its role by maximizing the number of people who are conceiving and testing ideas for the occurrence of mineral deposits at any one time on a continuous basis.

The geoscience data base is considered good or at least adequate by the majority of interviewees. However, DNRE utilization and dissemination of this data for maximum benefit to the province is considered less than adequate.

The present weak market for junior or exploration company shares and the risk-averse nature of the senior mining companies results in a paucity of opportunities for prospectors to market or option their prospects. The next and critical stage of evaluation, that is, drilling is deferred and full time prospectors, who once could make a living, become discouraged and drop out. Since there are few of the junior companies with any funds to spend, competition among the provinces for these scarce funds has become quite intense. Quebec offers the most lucrative incentives in both grants to companies and personal income tax savings for investors.

The junior company financing difficulty is evidenced by the fact that two of the 10 companies awarded $40,000 NBEAP grants in fiscal year 1999/2000 appear unlikely to find the required matching funds and thus will forfeit the grants.

Recommendations

3.1 DNRE should budget at least $300,000 annually for a comprehensive prospector development program. This budget should incorporate a training program, current funds budgeted for promotion as well as for a significant component to promote interest in prospecting in the broadest sense, and, an increased number of MESP grants averaging about $3,000/recipient/year, but with a maximum of $10,000.

A cash award of up to $10,000 should be given to anyone, whether or not a MESP recipient, who discovers a previously unrecorded mineral occurrence that is spatially and geologically distinctive. Details of the overall prospector development program should be resolved in consultation with the NB Prospectors and Developers Association.

3.2 Assign a greater proportion of the existing budget to the generation of reports on occurrences of commodities, both metallic and non metallic. Choose commodity priorities on the basis of perceived potential in the province and market trends. Draw analogies, where conceivably possible, with world scale mines in geological settings such as those of the commodity occurrences in New Brunswick. Make the reports Internet accessible and give search engines a selection of key words that will ensure "hits" by people doing searches for the commodity, associated commodities and all aspects of the geological setting.

3.3 Announce and begin to implement a goal of full electronic access to all technical data in DNRE files, including access to claim maps as well as both filing and access of assessment reports.

3.4 Announce a plan to adopt on a one-year trial basis in 2001 the 25% tax credit, or a variant thereof, as proposed by the New Brunswick Prospectors and Developers Association. The credit against the provincial share of income tax otherwise payable by New Brunswick taxpayers would be 25% of the portion of the purchase price of shares that is used for direct exploration in New Brunswick.

3.5 During the year 2000, the NBEAP program should be retained, but phased out or reduced thereafter, if the tax credit is successful in increasing the level of junior company activity.

3.6 Announce a plan to reward success with future tax benefits rather than get caught up in short term competition with grants and front end incentives for scarce exploration dollars. Under consideration should be stated to be a tax holiday for 10, or more, years. This would be from commencement of production from any mineral deposit not previously mined. The holiday would apply to the provincial share of income tax and to the mining tax collected under the Metallic Minerals Tax Act.

3.7 For maximum impact, encourage the Premier to make these announcements at major mining conferences such as the Prospectors and Developers Association or the Canadian Institute of Mining, Metallurgy and Petroleum.

3.8 Deep drilling

3.8.1 Drilling in New Brunswick

Deep drilling in the Bathurst camp and beneath New Brunswick's Carboniferous sediments is considered by many to be essential if there is to be future employment in mines of the current type.

Table 3.3: Surface Exploration Drilling in New Brunswick
(Metres drilled per year)

		Noranda Inc.				
Year	NB Total	Total	Brunswick	Heath	Bathurst Camp	Outside Camp
1988	100,521	N/A	N/A	N/A	N/A	N/A
1989	42,237	N/A	N/A	N/A	N/A	N/A
1990	96,112	N/A	N/A	N/A	N/A	N/A
1991	62,724	N/A	N/A	N/A	N/A	N/A
1992	64,948	N/A	N/A	N/A	N/A	N/A
1993	59,687	N/A	N/A	N/A	N/A	N/A
1994	48,370	N/A	N/A	N/A	N/A	N/A
1995	75,312	N/A	N/A	N/A	N/A	N/A
1996	90,854	54,985	9,753	27,500	16,510	1,222
1997	72,435	35,752	15,545	8,224	10,134	1,849
1998	N/A	21,808	8,522	0	12,236	1,050
1999	N/A	35,489	9,770	0	25,719	0

Note: N/A = not available

Sources: Natural Resources Canada & Gary Woods, Noranda Inc., personal communication

There is no economic case for deep drilling elsewhere in the province nor in the Bathurst camp, if the search is for gold or other types of deposits not currently being mined. As noted in Section 4.2, the creative deployment of new exploration technologies undoubtedly should contribute to making discoveries which were undetected previously, either because they were too deep or previous technologies were not sufficiently discriminating.

New Brunswick ranks high among Canada's provinces and territories in metres of surface exploration drilling per square kilometre of provincial area or of claims in good standing (See Section 3.4, Intensity of Exploration). The problem in New Brunswick is that too few companies are drilling and, furthermore, very little drilling is outside the Bathurst camp as is apparent from Table 3.3, (previous page).

Holes drilled by Noranda have increased in average depth since 1996 (Table 3.4, below) and many fewer shallow holes are being drilled as indicated by the following table. Part of the reason is encouragement in tracing the Half Mile Lake deposit at depth using deep drilling guided by innovative geophysical approaches. If Half Mile Lake proves to be a large economically viable deposit, other companies will adopt deep drilling and these exploration technologies which are relatively new to the mining industry. Should such a success coincide with a real increase in the zinc price, they undoubtedly would return to the Bathurst camp in a significant way.

Table 3.4: Noranda surface drill holes in New Brunswick categorized by depth

	Number of Holes				
Year	0-300 m	300-600 m	600-900 m	900-1200 m	>1200 m
1996	48	48	24	2	2
1997	26	22	11	10	3
1998	9	9	11	3	3
1999	4	10	10	1	14

Notes:
1. 1999 data refer to the 11 months to November
2. Of the three holes greater than 1200m in 1997, one was at Brunswick, one at Heath Steele and one at Half Mile Lake.
3. Of the 3 holes >1200 m in 1998, all were at Brunswick.
4. Of the 15 holes >900 m in 1999, 12 were at Half Mile Lake and 3 at Brunswick.

Source: Gary Woods, Noranda Inc., personal communication.

3.8.2 International comparison: Australian practice

When one compares the drilling and discovery record of companies exploring in Canada with those in Australia, it would appear that the issue with respect to Canada in general and New Brunswick in particular is how to cause companies to do more drilling in a smarter more cost effective way rather than just deep drilling.

Typically, the practice in Australia is to do grid drilling in favourable areas using a low cost non-coring method for shallow holes (50-100 m at <$15/m). This is followed by deeper testing of chemically anomalous zones using another slightly higher cost non-coring method. High cost (say, $100/m) core drilling is used for periodic holes to check reliability of assays from the lower cost non-cored holes. This approach, particularly in Western Australia, is in large part a consequence of limited usefulness to date of soil geochemistry or electrical methods for "seeing" through deeply weathered rock overlying fresh bedrock.

A company with an annual exploration budget of approximately $20 million and typical of those with a high discovery record would drill 300,000-500,000 m of exploration holes per year in Australia. Compare this with Noranda's 35,000 m, or so, in New Brunswick or the total of some 500,000 m drilled annually in Quebec by all companies.

Many companies (or geologists) in Canada seem to display a fear of drilling. Instead, it has been suggested that they put too large a proportion of funds into doing surveys which, regardless of the technology, can give only indirect evidence of the presence of mineralization and no indication with respect to economic viability. Drilling is almost a last resort. Yet, discovery and the economic potential of mineral deposits can only be confirmed by drilling.

3.8.3 Economic considerations

Another factor to consider when deciding whether or not to subsidize deep drilling is the economics of developing deep mines to exploit the kind of deposit most likely to be found. It would not be a productive use of public money if the majority of deposits of the type sought are marginal or uneconomic, even if found at or near surface, as in the case of the base metal deposits of the Bathurst camp. Government certainly would not wish to subsidize drilling of holes to depths of 1500 metres (~$150,000), or more, only to be faced with a decision as to whether or not to

subsidize shaft sinking to confirm an interpretation based on widely spaced deep probes from surface, much less subsidize bringing a deep mine into production.

Noranda did a study to determine the minimum size of deposit which would be economically viable should it be discovered at various depths and have ore of equal quality to Brunswick. If the deposit were to be below 1200 metres and more than 1500 m from existing mine workings, more than 30 million tonnes would be needed to justify development (Gary Woods, Noranda Inc., personal communication).

3.8.4 Comments and suggestions received

Following is a digest of the major themes that emerged from respondents' comments.

Private sector

- More deep drilling is needed to prove up mineral potential. Government should support it either through a cost-shared program such as Quebec's or by refunding tax payments made under MMTA to the extent of a company's drilling expenditures.
- The use of more innovative exploration techniques should be encouraged (e.g. seismic, gravity, microprobe, deep penetrating EM).
- Other approaches included: encouraging research and thinking on new deposit types; preserving and re-logging existing drill core; enforcing better water-well logs.

Public sector

- Because of deep folding, economic deposits are likely to be found at depth (similar to those known near surface). There is a good possibility of finding these by modern techniques and updated models. Promote academic research applied to New Brunswick conditions. Look under glacial overburden.
- Preserve drill core and publish an inventory of existing drill core on the web.

3.8.5 Policy Implications

The above analysis suggest strongly to the authors that an increase in the amount of drilling and the number of parties conducting it should be encouraged. Some investors have flow-through share financing (and/or the proposed NB tax credit) for their drill programs and are in a position to utilize the 150% exploration deduction under the Metallic Minerals Tax Act. Others, such as prospectors and juniors, do not have this advantage and require a different form of assistance.

Deep drilling in conjunction with creative use of "new" geophysical and geochemical approaches may prove to be the only effective means of finding more of the Brunswick-type base metal deposits in the Bathurst camp. However, the decision to drill deep should be driven primarily by market forces (metal prices, expectation of appropriate rewards, good infrastructure, etc.) rather than by incentives designed to put the cost of deep drilling more on par with shallow drilling. Therefore, if assistance is to be offered, shared-cost programs are more appropriate than outright grants.

We have noted elsewhere that innovative exploration technology can speed the rate of discovery. However, it does not follow that public funds should be spent on developing innovative technology or directly/preferentially encouraging its use. Availability of the proposed matching funds for drilling would cause explorers to use innovative approaches to locate drill targets and, hence, would be incentive enough. Once a commercial development results from use of innovative technology by the private sector, that development becomes the most effective incentive to cause widespread adoption of the technology.

We are intrigued by the suggestion that mineral tax revenues be dedicated to incentive programs and applied (within appropriate parameters) to extend the life of existing mining camps. In the absence of new viable discoveries, the Province is facing virtual collapse of mineral-related revenues. There would be good arguments for dedicating these revenues over the next few years to an intensive search for their replacement. This approach would give a solid test of the Province's mineral potential while the industry is still generating tax revenue from metal mining. Since drilling is the ultimate and most direct means of determining the mineral resource base, matching drilling costs with MMTA funds could be considered a productive replacement for NBEAP and complementary to MESP.

Recommendation

3.8 The province should seriously consider adopting a program under which it would match the surface drilling expenditures of any explorer (except for delineation of a deposit previously tested by more than 10 holes) between now and 2008 to the limit of government revenue for the previous year under the Metallic Minerals Tax Act (MMTA). This program could replace NBEAP.

3.9 Geoscience data base, expert advice to industry, and promotion

3.9.1 Introduction

In this section of the report, we combine the discussion of three subjects which were separated in the Terms of Reference. The geoscience data base and the expert advice of DNRE specialists to industry are subjects which are difficult to separate, as both are aspects of promotion. In many of our interviews, too, it was obvious that respondents used the word "promotion" as synonymous with the concept "support". We will adopt this practice as well.

Comments by private-sector users of the data base and DNRE advice invariably link data, interpretation of data and how the data is used for promotion to attract investment. Furthermore, private sector users of the data base and recipients of DNRE promotion and interpretation efforts are in a much better position to evaluate DNRE on these matters than the authors who have neither been conducting exploration nor providing consulting services on exploration projects in the province.

Comments by interviewees and questionnaire respondents concerning the geoscience data base and its dissemination by DNRE tend to be lengthy. They are recorded verbatim in Appendix D and summarized here.

3.9.2 Comments and suggestions

Our study elicited a vast amount of commentary on the subjects of this chapter from members of the New Brunswick mining industry and from government officials. We have attempted to identify the major themes that emerged and summarize them as follows.

Private sector

Geoscience data base

- The geoscience data base in New Brunswick is of generally good quality but is not as accessible as desired. Accessibility issues revolved around the non-standard form of the data (CARIS), the strongly-perceived need for Internet dissemination, and the preparation of maps which emphasize features useful to prospectors.
- Several suggestions were made for refining the focus of geoscience work. Do more work on: known deposits, deposit types and geological environments that tend to host major deposits; neglected areas such as the Carboniferous and the gold showings in the South; less "research" and more "applied" studies.
- Most respondents supported the preservation of drill core: some had suggestions as to obtaining it and handling it.
- Opinions on the release of assessment work differed: some supported prompt release, while others favoured allowing companies to keep it confidential as long as claims were in good standing. The transfer of assessment credits from property to property was favoured, as was electronic submission of data.

Expert advice to industry

- DNRE got good marks for its consistent support of industry. Suggestions for improvement included: being "less protective" of data; doing more compilations and interpretations of geodata; seeking ISO 9000 certification for quality of service.
- The Department does a lot with a limited budget. However, the following were identified as possibly questionable expenditures: the annual publication of a volume on "Current Research", and providing handouts such as briefcases and other mementos at meetings.

Promotion and support

- DNRE's efforts to promote investment in mineral properties was appreciated, but the budget of $20,000 is far too small.
- Sending selected prospectors to major conferences and shows is appreciated, but: the focus should be on the PDAC, rather than the Cordilleran; only the top prospects should qualify.
- To interest major companies: invite a CEO to give an annual keynote address in New Brunswick; enlist the Premier's involvement in national events.

Public sector

Geoscience database

- While the existing geoscience information base is of good quality, some of it is very limited by its age and relative lack of detail. There is a need for much remapping and new mapping work, particularly in the Northwestern part of the Province, the Carboniferous, the Caledonia belt and the Woodstock area. As well, needed geochemical and geophysical information is lacking. There should be more emphasis on metallogenic models and mineral deposit studies.
- Additional leverage could be obtained by a closer relationship with UNB and other universities, as well as with the Atlantic Geoscience Centre. Use of student field parties would generate more academic interest in New Brunswick.
- There is a widespread view that the Internet offers great scope for dissemination of information (including maps, assessment files, and mineral occurrence data). To realize this potential, more digitized data is needed: help could possibly be obtained from a new $60 million federal geomatics program.
- Some good geological work has been done in relation to industrial minerals, but relatively little geochemistry or geophysics. As well, effective follow-up work is lacking.
- Hydrocarbon-related geoscience (mapping, geochemistry, geophysics) is needed in the Carboniferous.

Expert advice to industry

- More interpretive work would help industry.

Promotion

- The current promotion effort is inadequate. In particular, while most of the effort goes into promoting metallic deposits, little is done for industrial minerals (the venues are totally different, most of them outside Canada).
- Effectively used (as in BC) the Internet offers huge potential for promoting investment in New Brunswick.
- Because of limited travel funds and bureaucratic travel controls, effective promotional work by government scientists is heavily restricted.

3.9.3 Policy Implications

It is notable that in many respects the perspectives of private-sector respondents are similar to those of government officials. It is clear that industry appreciates the important role that DNRE has

in mineral development. In may cases, the changes in focus suggested by industry are echoed by government officials. It is also clear that much potentially beneficial new work has been identified by both parties. The steady loss of resources that has occurred over several years, together with current budget constraints, means that this demand may not be satisfied for some time.

A strongly-felt theme emerging from both camps is that of using the Internet more effectively for both the dissemination of geodata and the promotion of investment. Early attention to the expanded use of this medium would multiply DNRE's effectiveness and impact within any given level of funding. The recommendations relating to the geoscience database and its effective dissemination and use for promotion that we consider to have immediate priority for meeting the objective of averting the demise of the metal mining industry are to be found in Sections 3.7 and 3.8. We believe these effectively respond to the themes identified in this section.

3.10 A regional perspective on policy suggestions

Reviewers of our draft report have pointed out that the geology, mineral potential, and exploration history of the Bathurst mining camp are different from those of other parts of New Brunswick. Although the Bathurst region has been intensively drilled and explored, other parts of the Province have been relatively poorly explored. A reviewer has suggested that some 90% of industry exploration expenditures have been spent in the Bathurst camp. Therefore the exploration statistics for finding an economic deposit refer mainly to that region.

Certain recommendations made in this report, such as assisting deep drilling and exploration technology development, will aid mostly discovery in the Bathurst camp. Programs such as Prospectors' Assistance will help mainly other parts of the Province.

4. Research and Development into Mineral Technologies

4.1 Introduction: the needs

In commissioning this study, the Government of New Brunswick showed an acute awareness of the potential offered by technology to enhance the position of the Province's mineral industry.

In recent decades, technology has had a major impact on every stage of minerals production (comprising exploration, mine development, extraction, ore beneficiation, product separation and purification right through to closure). The minerals industry of today is substantially more efficient, cleaner and safer than the one that existed at mid-century.

Research and technology have also enlarged the possibility of processing metals and minerals into an increasingly wide range of products. As one example only, consider the proliferation of space-age composites formed by combining disparate metallic and nonmetallic materials in the same structure. As building blocks for the new economy, these materials are immeasurably more valuable than their components, weight for weight.

Nevertheless, much remains to be done. New Brunswick has some particular challenges that technology could help to address. The Terms of Reference identified the following major issues:

- Exploration technology that would permit exploration to more significant depths would broaden exploration interest in all areas of the province (see Section 4.2).
- Some New Brunswick ores have encountered difficulty in their metallurgical processing. If solutions could be realized in this area, it would augment the values of both large and small deposits (see Section 4.3.1).
- Metallurgical technology that would permit the economic reprocessing of New Brunswick's extensive tailings would allow further economic activity while possibly dealing with a long term environmental liability (see Section 4.3.2).
- Smelting technology development would further augment metal recoveries (See Sections 4.3.3, 4.3.5).

Each of these major needs is discussed below in the sections referenced. As well, this chapter contains discussion of other processing technology themes identified in the Terms of Reference.

4.2 Exploration technology

The Bathurst camp of New Brunswick is a well-explored area compared with other Canadian jurisdictions. In relation to other provinces, its land area is relatively small. Following the spectacular success of base-metal exploration by geophysical means in the 1950s, New Brunswick became a favoured environment for prospectors, junior exploration organizations and major companies alike. In recent years, the rate of discovery per dollar spent on exploration has declined. There has not been a major viable discovery for a number of years. The details of this history are spelled out in the preceding chapter.

Logic tells us that the discovery rate depends on three factors: the mineral potential of the area, the amount spent on exploration, and the effectiveness of the exploration techniques used. Government policies can do little to improve mineral potential, but they can affect the other two factors.

While major companies have maintained sizeable exploration budgets in the hope of prolonging the economic life of existing processing assets, spending by prospectors and independent explorationists has decreased. This is not necessarily because New Brunswick's mineral potential is viewed negatively. As the previous chapter details, knowledgeable opinion is divided as to whether the Province's mineral potential is sufficient to sustain past production levels into the future.

All agree, however, that the deployment of a new generation of exploration technology could well result in the discovery of attractive new deposits. In particular, many believe that sizeable base metal deposits remain to be discovered at depth and that techniques capable of looking deeper into the earth's crust will offer the best chance of success. Any such technology would also stimulate new exploration spending.

The application of new technology is usually evolutionary. The effective application of revolutionary new techniques is rare (one such breakthrough was the application of new geophysical techniques in the post-war era).

The evolutionary aspect is well illustrated by the application of seismic technology to hard-rock environments. This technique has been successfully applied to petroleum exploration in sedimentary environments for a few decades. Its effective application to metal exploration is an outgrowth, largely made possible by advances in computing capacity and other supporting technologies.

The value of seismic exploration in the New Brunswick context is being tested by Noranda in searching for large, deeply buried base metal deposits in the Bathurst area. While initial results are sufficiently promising to warrant commitment of further funds, it is far from certain that an orebody will be discovered.

Policy implications

Should the Government of New Brunswick attempt to influence the further development of exploration technology? The role of government incentives for processing technology is explicitly discussed later in this chapter, but there are no similar programs specifically for exploration technology. The authors argue that a supportive approach by government to private-sector initiative is preferable to launching a new government-supported research program on mineral exploration technology.

There are several reasons for this stance. First, applied research is a high-cost activity and any single research initiative has a low probability of success. Secondly, it needs to be remembered that technology is a mobile economic factor. It is sometimes possible but always difficult to protect intellectual property in new technology. The probability of New Brunswick's profiting exclusively or preferentially from a technical breakthrough which permits discovery of base-metal deposits at depth is extremely remote. Other jurisdictions would equally reap any benefits.

Over the years, various private-sector mining research consortia have studied improvements in exploration technology. As well, academic researchers in relevant disciplines have worked on the problem. Some of these initiatives may yet bear fruit. It is doubtful that a small province such as New Brunswick has the resources or the concentrated pool of expertise to make a significant difference in the field of exploration technology. However, to the extent that local academics and businesses do choose to work in the field, the Province is well advised to be supportive within the parameters of existing programs.

One potential problem is the apparent lack of interest in academia and the private sector in pursuing such developments. Perhaps the most effective short-term action that could be taken within existing resource levels would be to assemble interested parties and challenge them to contribute blue-sky ideas to the search for new exploration technologies that would have special application in New Brunswick.

Recommendation

4.1 Under existing R&D support programs, the Province should assign some priority to assisting private-sector and academic research into exploration techniques of potential application to New Brunswick conditions. In particular, the Department of Natural Resources and Energy should sponsor a one-to-two-day seminar for academics, mineral professionals and technology firms to explore new approaches to mineral exploration techniques.

4.3 Processing metallic minerals

We will discuss the processing of metallic minerals in three subsections, each one related to one of the major themes identified at the beginning of this chapter. Since the term "metallurgical processing" used there refers to all processes for the separation and purification of metals from their ores, our discussion will tend to use more specific terms. For the initial processing or beneficiation of ores, we will use "milling" or "concentrating." For the ultimate separation and purification of metals, we will refer to "smelting", "refining" and "hydrometallurgy" as appropriate.

New Brunswick's metallic ores tend to be unusually fine-grained and contain several metals. While these characteristics are marked in the case of New Brunswick, they are by no means confined to the Province. Many other jurisdictions around the world have similar ores, formed by similar processes. The geology of parts of Newfoundland, for example, is quite similar to that of parts of New Brunswick.

The recovery of metals from such ores is complicated and costly. Operators using conventional concentrator flowsheets experience poor separation of metals and high metal losses to tailings. Achieving acceptable concentrate quality in the separate zinc and lead concentrates involves extra grinding, the preparation of a "bulk concentrate" containing a mixture of the two metals, and low concentrate grades (resulting in higher smelting costs).

A good many promising deposits have been uneconomic to date or have operated only intermittently because of the difficulty of recovering metals from this type of ore. Improved technology applicable to these ores could unlock new value from known deposits. This goal may be approached through incremental improvements of existing processes or through finding radical alternatives (such as hydrometallurgy) to the conventional milling and smelting steps.

Though the Brunswick mine has operated continuously, the inherent difficulties have exacted a heavy economic cost because of both low metal recovery rates and inflated processing costs. It is a tribute to the size and grade of the Brunswick orebodies that the Brunswick mine has operated as profitably as it has over the years. Other mines in the area, similar but smaller, have a history of intermittent operation and have never recovered their investments, let alone turned a profit.

Aside from the economic cost, the poor metal recovery has left a legacy of millions of tonnes of tailings with high concentrations of valuable metals. We will deal with these in Section 4.3.2.

4.3.1 Initial processing (milling) of New Brunswick ores

Noranda is the operator that has had the most practical success in mitigating the problems inherent in processing the fine-grained polymetallic ores of the Bathurst camp. The Company has achieved over a period of years substantial improvements in the economics of metal production. This was achieved little by little, through a combination of incremental process changes in milling operations, capital expenditures and, in recent years, a greatly improved understanding of the physico-chemical processes at work in the milling stage.

To capitalize on this hard-won expertise, the Company recently announced that its worldwide centre of milling expertise is henceforth to be located at Brunswick. It also has stated that it considers its milling expertise as valuable intellectual property, giving it a global advantage over international competitors. This advantage may well be demonstrated in making profitable investments in other Brunswick-type deposits, capturing investment opportunities in which other companies would not be equally successful.

Policy implications

The milling technology or know-how described here is of clear value to New Brunswick. For one thing, it will improve the profitability of the Brunswick mine for the remaining years of its life. As

well, should Noranda's heavy exploration program in the Province be successful in identifying one or more new viable orebodies, then any resulting mine will have a more secure future because of it. Moreover, Noranda has stated that it has already offered some assistance to other mine operators, and this is of obvious benefit to New Brunswick.

However, it must be understood that Noranda's technology opens new opportunities globally for the Company. Obviously, any deposits that are of increased interest to Noranda because of its special expertise will not be confined to New Brunswick. The Company has a powerful incentive to open new viable mine production within the Province because of the existence of its Belledune smelter, and it will find its milling know-how of value to this objective. But the technology itself is mobile and the benefits cannot be appropriated by the Province to the exclusion of other jurisdictions.

No recommendations are offered in this area.

4.3.2 Reprocessing of tailings

With the impending closure (in perhaps ten years or less) of the Brunswick Mine, the Company has had to consider other ways of profitably using its milling facility.

Noranda's particular expertise in milling opens the possibility of profitably reprocessing old tailings to extract metal which until now would have been considered lost. The Company has stated that it is considering such a project. As indicated above, there is a large inventory of tailings at the Brunswick site. With Noranda's improved milling technology, it might be possible to recover metal with an in-situ value around $12 per tonne of tailings. This small per-tonne payoff does not leave much room for error.

Aside purely from the value of metal recovered, however, the reprocessing of tailings has environmental advantages. Removal of a portion of the contained metal sulphides would reduce the acid-forming potential of the residue. As well, reprocessing offers an opportunity to redeposit the stripped tailings in a more stable configuration (both physically and chemically). This in turn may reduce the cost of effective reclamation and could possibly avoid long-term site care.

There are stockpiles of high-metal-content tailings at other mine sites, including Heath Steele. Some have suggested bringing them to the Brunswick Mill for reprocessing. According to Noranda, the value of the metal contained in the tailings does not justify the cost of bringing tailings from other locations for reprocessing. If a way could be found to capture the environmental credits, perhaps custom reprocessing might become economic over a wider radius.

Policy implications

If the Brunswick tailings reprocessing project proves to be economic, it may well allow one company to dispose of its residual tailings in a condition or configuration which is more environmentally stable than the current tailings. In the event of mine closure, the project could also permit the continuation of employment for a certain fraction of the workforce.

Should the Province wish to encourage the reprocessing of tailings at Brunswick and other locations, it may need to investigate the possibility of creating the appropriate incentives. As a starting point, it would be appropriate to consider how the environmental advantages could be captured most economically by all operators.

Recommendation

4.2 The Province should consider sponsoring a one- to two-day seminar for operators, academics (including economists) and technology firms to interest them in exploring ways to capture environmental benefits and make the reprocessing of tailings from a wider area more economic.

4.3.3 Smelting

The Province's only smelter is the Belledune lead smelter, operated by Noranda Inc. With the impending closure of the Brunswick mine, the future of the smelter is in doubt. The Company has recently begun to examine its options with regard to the smelter.

The history of Noranda's Horne smelter (Rouyn-Noranda) is instructive. Built in 1926 to process copper ore from the Horne mine, the smelter also accepted custom concentrate from other mines, mainly in Quebec. As production from the Horne mine declined, the proportion of custom feed increased. Sources became diversified to include western Canada and, eventually, Latin America. By the late 1970s, the mine was completely shut down and the smelter had become wholly a custom operation. Its feeds now include, besides concentrates of copper and precious metals, a substantial proportion of metallic wastes, which it profitably recycles.

The Company is now studying how to create a similar future for Belledune, assuming no replacement mine is forthcoming. A major, detailed technical and economic study has been undertaken to identify commercial sources of suitable custom feed, to determine what physical process modifications would be required to handle each feed, and to assess the economics of doing so. Decisions are required as to which options to follow and how to stage them. Critical decisions must be taken well in advance of the depletion of the Brunswick mine in order to maintain continuity of operation.

Policy implications

The Company's decisions, based on the options open to it at any time, will have far-reaching implications for the region. Government will wish to ensure that it is well informed as the smelter studies proceed and that its policies and programs contribute to a smooth transition at the Belledune smelter.

No specific recommendations are offered.

4.3.4 Reprocessing of smelter slag

As is the case with tailings deposited some years ago, there is a vast inventory of smelter slag related to the Belledune operation. This waste material contains appreciable amounts of zinc and other metals. According to a newspaper article (New Brunswick Telegraph Journal, September 17, 1999) the zinc content is as high as 11%. The availability of this material opens the way for consideration of a way to recover valuable metals. The method being considered is a high-temperature process for zinc fuming.

The Company has stated that the zinc recovery process is one component of the major smelter study mentioned above. A big investment would be required in a zinc fuming plant. It would treat smelter slag and other residues, as well as furnace dust from electric steel plants. Some lead would also be recovered. The process being considered is highly sophisticated, possibly with a tendency towards instability. It would require extensive control instrumentation and top skills among employees.

The Company has also considered a tailings reprocessing project in which tailings would be sintered, then sent to zinc fuming for recovery as ZnO. The capital cost was too high for economic operation. However, the same process might be viable starting from a bulk concentrate.

Policy implications

Similar to those shown above for the entire smelter options study.

4.3.5 Alternatives to smelting

Over many years, suggestions have been made for a comprehensive new approach to the problem of recovering metals from the New Brunswick fine-grained polymetallic ores. Alternative processes were studied for several years by the New Brunswick Research and Productivity Council. It was also the subject of a major multi-year research program at CANMET, the research branch of the federal Department of Natural Resources. CANMET's contribution was the development of the "Ferric Chloride Leach" process, a hydrometallurgical process for separating and purifying metals in one step.

Other Canadian organizations, including the private-sector corporations Cominco, Sherritt Gordon's process research arm (now located at Dynatec) and Lakefield Research, have developed and commercialized hydrometallurgical processes for extracting metals from their ores. In some cases these processes were environmentally attractive because sulphur present in the ore was removed as elemental sulphur, a relatively inert form. In conventional milling operations based on sulphide ores, reactive sulphides are often discharged with the tailings.

The concept of replacing traditional "messy" and complex operations, such as milling and smelting, by clean, elegant, well-controlled modern chemical processes has tantalized scientists and policy makers for a long time. It is natural to enquire whether a suitable hydrometallurgical process exists for the New Brunswick ores and whether it could be economic. The answer seems to be "yes and no."

The CANMET Ferric Chloride Leach research was eventually discontinued by management because it could not attract private-sector support. The process seemed to give good results technically, but the required economic advantage was not there.

This termination decision was made several years ago, before Noranda had achieved its exceptional improvements in the traditional milling process. Today, the choice would be even clearer. When asked by the author if it had considered a hydrometallurgical option, the Company replied that it had done so, but efficiency improvements were marginal above those currently obtainable with conventional technology and the required investment could not be justified.

The question naturally arises whether some unconventional technology such as hydrometallurgy could unlock the metal values in typical New Brunswick ores more economically than milling and smelting. Would this approach make other known base metal deposits viable? If another company were to consider developing a new smelter, it might come to a different conclusion regarding the viability of a hydrometallurgical plant since it would not have ties to an existing facility. Other than Noranda, however, there is at present no known company which is considering a major metallurgical investment.

The government has consistently shown interest in seeing new metallurgical processes established in the Province and has commissioned a number of studies and initiatives. While these efforts have been without result to date, DNRE continues to be desirous of stimulating the search for better alternatives.

Policy implications

The idea of replacing conventional smelting and milling operations by a hydrometallurgical or other modern process is conceptually attractive and new technical developments should be reviewed from time to time. The Province has been quite active over the years in monitoring and studying new process options. We believe this level of activity is well justified. However, until a new metallurgical plant is "needed" in the Province (on the basis of an assured supply of economic base metal feedstock and a gap in international processing capacity), little is to be gained by strenuous efforts to create artificial momentum.

Recommendations

4.3 The Province should continue its practice of reviewing metallurgical developments of potential application to New Brunswick fine-grained ores approximately every five years.

4.4 If any process identified in such a study seems to hold particular promise under the conditions applying at that time (e.g. existence of one or more substantial new base metal deposits and international conditions warranting a new metallurgical plant), the Province may wish to become actively involved with industry and the federal government in promoting such investment.

4.4 Industrial minerals: value-added processing opportunities

New Brunswick's major industrial mineral is potash. Produced by a single company, Potash Corporation of Saskatchewan at Sussex, potash is used almost exclusively as an essential component of fertilizer. There is also production of peat, quartz, and salt. In the category of structural materials, the province has a substantial production of sand, gravel and stone, and also produces lime.

The scope for adding value to these commodities in New Brunswick is limited but individual opportunities undoubtedly exist. The authors are aware of one such entrepreneurial initiative, Havelock Lime's production of a value-added potassium chemical from lime and potash.

Policy implications

Respondents to our survey have suggested that government create an economic development team to identify and promote economic opportunities for new products based on the Province's minerals. On reviewing this suggestion with officials, we learned that such an interdepartmental committee exists, but that it has lost its only member having processing expertise. There is a need to replace this expertise and create a "champion" within government for this activity.

There is also scope for reviewing relevant technology assistance programs (discussed below).

Recommendation

4.5 The Department of Natural Resources and Energy should attempt to strengthen its multi-agency team of officials charged with identifying potential markets and value-added processing opportunities for industrial minerals by replacing needed processing expertise.

4.5 Environmental technologies

Mineral industry operations are by nature somewhat intrusive on the environment. The significance of the impacts generated by the mining and processing industries in Canada, relative to those of other human activities, can be debated. Nevertheless, governments and the private sector have agreed on the necessity of minimizing these impacts to the extent practicable.

The chief environmental issues facing the mining industry, in both Canada and New Brunswick, are both related to the presence of sulphur in typical metal ores:

- Mining and milling activities expose minerals to the environment and sometimes (when sulphide minerals are involved) generate acid rock drainage.
- Smelters convert sulphur in concentrate to sulphur dioxide (SO_2). Unless captured, it can contribute to acid rain.

In recent years Canada has seen considerable progress in controlling both these classes of impacts, but the current solutions are not perfect.

4.5.1 Control of acid drainage

There are unfortunately many abandoned mine sites in Canada causing environmental damage to local water resources because of uncontrolled acid rock drainage (ARD). Some of these mines terminated operations before the phenomenon of acid drainage was recognized or understood, and before its significance was appreciated. Others have resulted from the failure of the operating company before site rehabilitation could be completed.

It was to avoid these situations in future that industry and government began, in 1986, to study ARD with a view to controlling and eventually eliminating it. After two years of preliminary work, a detailed program of research was devised. Five major Canadian mining companies made initial financial commitments of $500,000 each, and matching commitments were sought from the federal government and relevant provincial governments. These were obtained, in varying proportions. New Brunswick was one of the original funding partners.

The cooperative research program, called MEND (Mine Environment Neutral Drainage) continued actively until 1997. During the life of the program, nearly $20 million was spent on laboratory and field research to find effective methods of predicting, measuring, and controlling ARD. The program captured international attention and gave rise to a bi-annual international conference on ARD, which attracts experts from around the world.

On the conclusion of the active research phase of MEND in Canada, the cooperative concept was taken international when certain Canadian companies joined with others based in Australia, USA, and elsewhere in a widened research network on ARD (the International Network on Acid Prevention). A MEND technology transfer office has continued to function in Ottawa.

Has the problem of ARD been solved? Not in all cases. But great progress has been made in understanding, predicting, and controlling it. Design principles have been developed which can be used to reliably prevent or minimize its formation. Effective control techniques are available which can minimize environmental effects.

Control technology revolves around preventing the access of air which acts to oxidize sulphides in tailings and waste. This can most effectively be done starting with mine design and continuing through operation and closure, by:

- segregating active waste rock and covering it with inert material or water;
- selecting suitable tailings disposal areas which will be physically stable and which can eventually be covered;
- operating all processes in such a way as to minimize the exposure of active (acid-generating) rock and tailings to air (e.g., by depositing tailings under water);
- reclaiming the site to ensure all active material remains segregated from oxidizing environments;
- ensuring the long-term stability of the site, if necessary by providing continuing monitoring and hands-on management.

These principles have been tested in a few new mines and found effective. As well, they have been adapted to the re-working and rehabilitation of old sites (notably two uranium-producing complexes near Elliot Lake). Again, the operating results are impressive.

In particular, water covers (e.g., a flooded tailings area) have an interesting characteristic. Over time organic material such as dead leaves begins to build up in the pond and living organisms such as cat-tails colonize it. Wherever organic debris rests on the pond bottom (top of tailings layer) a reducing environment is created and this prevents and even reverses the oxidation of tailings.

The major remaining concern is long-term stability of the structures. If water cover is used, how can we guarantee that the pond will remain firmly in place and that no failures will occur, even in the case of seismic events? In this situation, the best and only solution to this challenge to date is the long-term care and monitoring of the site. It is for this reason that governments are requiring companies to deposit substantial financial security to finance long-term care, where it is required (see Reclamation Securities, Chapter 5).

Comments and suggestions received

Some respondents to our survey (see Appendix D for comments) feel a particular sense of urgency about resolving the issue of long-term stability and guaranteeing a walk-away solution in every

case. Until technology can provide a guaranteed solution, how can we say the problem has been solved?

Policy implications

It is difficult to argue with the general concern expressed above. At the same time, it should be remembered that the science of acid drainage is still in its infancy. It is less than 15 years since the first research was launched. Many corporations and institutions are actively involved in seeking better solutions. New Brunswick, while it has limited resources, is in the forefront of these efforts.

The Province has been a member of the MEND consortium since the very beginning and has contributed to the progress that has been made. Officials continue to stay in touch with the MEND Secretariat and otherwise monitor developments in this evolving technology. They review current publications, attend conferences and maintain dialogue with industry on acid drainage. There is one full-time position dedicated to Environment / Reclamation Engineer.

The Province has also taken a proactive policy stance, requiring progressive engineering measures for acid drainage control and reclamation from the beginning of mine design. See Section 5.7 for a brief description of the reclamation objectives required of new mines. DNRE considers that this approach is successful in practice. One recent mine (the Restigouche mine) submitted a "walk-away" reclamation plan and has very tight environmental controls to ensure acid drainage does not get out of control.

The Province seems to have the issue of acid drainage technology well in hand. The authors have no recommendations.

4.5.2 Control of smelter SO_2 emissions

Under an international agreement with the USA in 1984, Canada agreed to limit the emission of acidic substances including SO_2. As the major Canadian point source of SO_2, base metal smelters were targeted for control action by participating provinces. Emission reductions averaging 50% were required over a 10-year period.

The technology employed to achieve these reductions varied from smelter to smelter, depending on local conditions, but it was for the most part conventional: capture of the smelter off-gases and the conversion of contained SO_2 into commercial grade sulphuric acid. The acid newly produced was successful in finding markets, mainly in the USA. Sales revenue, while extremely modest, helped to offset the heavy capital cost of the plant modifications.

At INCO Sudbury an acid plant was built, but significant changes were first made to the milling circuit and concentrate composition in order to exclude a portion of the sulphur from smelter feed. In only one case, involving the Hudson Bay smelter in Flin Flon, Manitoba, was the pyrometallurgical process converted to a hydrometallurgical zinc plant. While production of sulphuric acid would have been cheaper in terms of capital, the high cost of hauling the acid to distant markets tipped the scales in favour of hydrometallurgy. Even so, a major federal subsidy was required.

Canadian smelters as a group have continued to reduce their SO_2 emissions per unit of output since then (source: MAC's Environmental Progress Report). One reason is that the operating companies have continued to make incremental process changes to improve performance. Another reason is that some smelters, including Noranda's Horne smelter and Falconbridge at Sudbury, have substituted metal-containing scrap for a portion of the regular smelter feed. This is a triply-neat solution, as it improves smelter profitability while eliminating the disposal of metal scrap and reducing sulphur emissions.

Policy implications

Is the current level of smelter emissions sustainable? Should new technology be applied to reach lower levels? Definite answers to these questions are impossible at present. However, we are on the way to answering them. The adequacy of air pollution controls at base-metal smelters is the subject of a special review process involving both levels of government and industry. Called the "Strategic Options Process", this study will assess the needs of the environment by reviewing available data on the impact of current smelter emissions. As well, the capabilities of the current technology will be assessed in relation to other technological options. New Brunswick will wish to be fully involved. The authors suggest that no independent provincial technological initiatives are warranted in the meantime.

Recommendations

4.6 The Province should participate in the base metal smelter strategic options process in order to assess needed technologies.

4.6 Processing technologies assistance

The New Brunswick government offers two forms of assistance to promote processing of mineral commodities. One is tax-based, in the form of a tax credit under the Metallic Minerals Tax Act (MMPA). The other is a direct financial incentive or grant, under the Value Added Mineral Processing program (VAMP).

4.6.1 MMTA tax credit

Section 2.1(2) of the Metallic Minerals Tax Act reads as follows: "The operator of a mine shall, after the date of commencement of production, be granted one tax credit against the tax payable under paragraph (1)(b) equal to twenty-five per cent of the eligible process research expenditures." Eligible research expenditures means "the actual costs incurred after the date of commencement of production of any research approved by the mine assessor prior to being undertaken that has as its objective the recovery of additional mineral products." If the credit exceeds the tax payable in any year, it may be carried forward from year to year.

This provision promotes research into mining methods and could lead to the development of mining technology or know-how. It is possible also that research on milling and smelting processes could well lead to improved recovery of the resource by reducing metal content in discarded materials such as mill tailings or smelter slag. It would appear that such research would be eligible for assistance under the Act.

The authors have received only one comment on the issue of incentives for processing under the MMTA. It suggested that this incentive may be more effective if the MMTA did not place limitations on ownership of the facility or on the source of the feed.

To our knowledge, there are no current policy implications of this tax credit and no recommendations are offered.

4.6.2 Value Added Mineral Processing program (VAMP)

The VAMP program supports projects designed to improve recoveries or create value-added products, thus enhancing the value of mineral resources. The program is designed to pay up to 50% of project costs to a maximum of $30,000 per project, minimum $5,000. Government funds are paid 30% up front and the remainder when the work is complete.

Eligibility criteria are flexible, including private sector holders of mineral rights, others in the mining business and certain public agencies. Other criteria for assessment of applications are also rather flexible. The main objective is that some practical application of technology be developed and used at the end of the day. "Blue sky" research does not qualify. As a cost-shared program, VAMP requires the project originator to make a commitment to the project in advance of government assistance. Unusual for an assistance program, in recent years the annual allocation of funds has not been fully used.

Comments and suggestions received

A number of respondents suggested the need for a system of small grants to entrepreneurs to test new ideas before applying for more substantial assistance. There is precedent for this approach in the Province's Mineral Exploration Assistance Program, which makes grants of up to $3,000 to support grass-roots exploration activities. Other users of the program suggested that progress payments be made, similar to the federal IRAP program. Still others suggested the selection criteria be clarified and that the scientific and technical community be challenged to come up with more ideas relevant to New Brunswick's needs.

Policy implications

There is considerable support for the redesign of VAMP to permit small grants for exploratory stages of R&D programs. There also appears to be merit in clarifying the selection criteria to resolve any misunderstanding by potential users about the purpose of the Program.

Recommendations

4.7 Revise the conditions of the Value Added Mineral Processing program in order to offer unmatched grants of up to $5,000 to permit preliminary investigation of new concepts and technology. Dedicate a portion of the annual funding (say, 20%) to this purpose.

4.8 Publicize the Province's needs for technological answers to mineral processing problems and challenge the academic and scientific communities to come forward with ideas. A technical seminar similar to others proposed in recommendations 4.1 and 4.2 could be considered.

5. Government Legislation; Mineral and Fiscal Policy

5.1 Introduction

Government policies and legislation can have a powerful influence on the viability and performance of a province's mineral industry. They can have a rapid and critical influence on the decisions of explorationists and investors as to whether or not to risk their efforts and money in the jurisdiction. Rapid policy reversals and inhospitable legislation can drive investors away.

This truism is amply demonstrated by the experience of Latin America in the 1970s. Nationalistic governments used crude methods to gain more control of their mineral resources, setting back the development of the region for years. A similar phenomenon occurred in British Columbia around the same time (and seems to have repeated itself recently).

On the other hand, a province can improve its chances of attracting mineral investment by maintaining stable and balanced policies which offer mineral developers a fair return while safeguarding the public interest. New Brunswick has traditionally been considered a hospitable jurisdiction. It has a good reputation today among mining company executives, as has been demonstrated by the surveys conducted by the Fraser Institute. Selected results of the most recent survey are quoted in several of the following passages.

Notwithstanding the generally favourable opinions held about New Brunswick, the Province has seen a secular decline in exploration spending, mineral production, and new mine development. In these circumstances it is appropriate for the Government to ask, "what more can we do?" This question is at the heart of the current study. The Government has asked the authors to identify any shortfalls in policy or legislation and suggest improvements.

This chapter contains detailed analyses of various policy areas which can have an impact on investment behaviour.

5.2 Regulations

Mineral industry activities are subject to a vast number of regulations in fields as diverse as environment, worker health and safety, obtaining mineral tenure, the issuance of securities, competition law, transportation, product labelling, etc. For the purposes of this study we are seeking to identify and comment on those regulations that can significantly influence decisions whether or not to carry out mineral exploration and development in New Brunswick.

Therefore, we will restrict the subsequent discussion to environmental regulation as it applies through the stages of mineral exploration, development, and operation of mining and processing facilities. A closely-related topic, mine reclamation and the requirement to provide financial assurance for it, has an environmental purpose but it is considered in a separate section.

5.2.1 Legislative Structure

The federal and provincial levels of government exercise concurrent jurisdiction over the environment and its protection. Therefore, mineral industry activities are subject to legislation and regulation emanating from both.

Federal legislation

Mining and smelting operations are routinely subject to the provisions of several pieces of federal environmental legislation. An exploration project may encounter one or more of these, depending on its scope and site conditions.

- For water, *The Fisheries Act,* governs the preservation of fish habitat and the release of "deleterious substances" into water courses. Regulations under the *Act* dictate such matters as construction standards for stream crossings or other physical work and allowable concentrations of substances in liquid effluents from a mine, mill or smelter. These regulations are uniform across Canada. They are administered by Environment Canada, except where this has been delegated to a province.

- Air emissions control is largely the jurisdiction of the provinces. However, the federal government can and does influence provincial regulation, as it did in obtaining massive reductions in allowable smelter emissions of sulphur in the early 1990s.
- Where a substance released to air or water is defined as "toxic", the provisions of the *Canadian Environmental Protection Act* come into play. These allow the federal government to impose a wide range of restrictions and conditions on the polluter.
- A major project, such as a new mine, is subject to environmental assessment under the *Canadian Environmental Assessment Act* (CEAA). This Act is triggered when any statutory decision is required by any federal department or agency (e.g., if a federal grant is involved; if the facility will require a permit authorizing it to alter fish habitat; or if it requires any permit under any other federal legislation). For mining projects the usual trigger is the *Fisheries Act*.

Provincial legislation

Exploration, mining and processing activities are subject to the following provincial requirements:

- Exploration activities are governed by "Standard Conditions for Mining Exploration Projects", a compilation of the requirements of the Department of Environment; enforced by DNRE as a condition of commencing exploration work.
- Exploration must also meet additional rules and regulations under the *Clean Water Act* and the *Clean Environment Act*, if the exploration work is to be performed in a surface water supply watershed.
- The *Water Quality Regulation* under the *Clean Environment Act*; and the *Air Quality Regulation* under the *Clean Air Act*. These regulations together govern the approval of industrial operations. Approvals are accompanied by conditions which control construction and operating activities including the quality and quantity of contaminants which may be discharged from a facility. This system is similar to that of other provinces in that industrial plants operate under a "Certificate of Approval".
- New projects such as a mine or smelter are subject to environmental assessment under the *Environmental Impact Assessment Regulation* of the *Clean Environment Act*. The two-stage process requires that certain undertakings (listed in a schedule to the Regulation) be registered with the Minister of the Environment. Its application at the early design stages of a project allows environmental objectives to be integrated with economic objectives before

final decisions are made. The Minister may determine that a full environmental impact assessment (EIA) is necessary to assess the nature and significance of the potential impacts through further study. The outcome of the EIA process is a report and recommendation to the Lieutenant-Governor in Council, who is responsible for making a decision on whether to allow an undertaking to proceed.

5.2.2 Regulatory reform initiatives

For a decade or more, mining companies and their associations have deplored the increasing regulatory burden in Canada. The industry has consistently complained about the complexities, costs and delays inherent in a regulatory system in which it seemed the federal and provincial jurisdictions could not get their acts together. This was the motivating factor for the Whitehorse Mining Initiative. By the mid-90s, the federal government undertook to promote regulatory reform in several sectors, including mining. As well, federal, provincial, and territorial mines ministers instructed their officials to seek ways to reduce the burden on this industry, and a task force involving both levels of government and industry was formed.

Work of the IGWG / Industry Task Force on Regulatory Reform resulted in the publication in July 1998 of an overview report on the "Federal-Provincial-Territorial Review of Environmental Regulations Affecting Mining in Canada." This report documented the nature of the existing problems, it reported on the progress made in each jurisdiction towards resolving them, and it noted that much scope existed for further progress. New Brunswick reported on the creation of its Standing Committee on Mining and the Environment. Other provinces reported on their streamlining initiatives, some quite similar to New Brunswick's. While some progress has been made within jurisdictions, industry maintains that little rationalization has occurred between the two senior levels. Certainly, while New Brunswick's Standing Committee was regarded as a positive development, it did not necessarily improve the attractiveness of this Province relative to others, since other provinces made similar gains.

5.2.3 Rationalization of federal and provincial regulation

Notwithstanding the good work of the IGWG Task Force, there remains considerable duplication and overlap of federal and provincial regulation. While no jurisdiction has abandoned any item of

legislation, some efforts have been made in recent years to harmonize the *application* of the legislation at the two levels. For example, most recent environmental assessments of mining projects have been done cooperatively in a single, combined process involving the federal and provincial agencies, under principles hammered out by the Canadian Council of Ministers of Environment (CCME). However, the CCME harmonization accord merely ***encourages*** the ministers involved to cooperate in assessments. It does not require them to do so. We would favour the complete harmonization, rationalization and integration of federal and provincial environmental requirements into one seamless system of regulation.

At the operating level as well, the federal *Metal Mining Liquid Effluent Regulations* set a uniform Canadian standard for the maximum concentrations of contaminants entering the aqueous environment. However, provinces are free to set a higher standard, and sometimes do so. The national system of environmental effects monitoring now in place for metal mines provides an objective feedback process for assessing the "correct" level of protection. Once substantial effects monitoring data are in place, it will be easier to set adequate and justifiable standards of protection.

5.2.4 Streamlining provincial regulation

Even within the Province, different agencies are involved in regulating the industry. Aware that this fragmentation of responsibility could result in inconsistencies, delays, and costs, New Brunswick has examined ways of streamlining the regulatory function. In 1988, it established a "Standing Committee on Mining and the Environment" whose membership comprises equal numbers of officials from DNRE and DOE, together with one official from Environment Canada. Input from representatives of other departments or organizations may be requested to deal with specific issues. The Committee's objective is "to provide timely and consistent technical review of approvals related to mineral exploration, mine development, mine operation, and temporary and permanent closures as required by the policies and legislation of the Province of New Brunswick."

This Committee has a similar function to that of the "One Window Process for Mine Development Approvals" in neighbouring Nova Scotia. The latter has as a goal to "simplify the review process for both the mining industry and for government." Its standing membership comprises officials from the Nova Scotia departments of Environment, Natural Resources and Labour. In addition, other government officials are involved as required, including representatives of the NS Economic

Renewal Agency, NS Department of Transportation and Public Works, Environment Canada, Fisheries and Oceans Canada, etc. The Nova Scotia One Window process has been described in detail in an attractive and comprehensive 30-page document intended to assist mining proponents to find their way through the regulatory system. There seems to be a genuine interest in expediting regulatory approvals.

It is beyond our scope to review the effectiveness of the Nova Scotia model or similar structures in other provinces. However, we have received several comments to the effect that the New Brunswick Standing Committee is not working as smoothly as is desirable. We will suggest that the Province review the operation of the Standing Committee with a view to improving it. As part of that review, officials may wish to compare their experience with that of Mines officials in other provinces.

5.2.5 Comments and suggestions received

The most recent survey of mining companies by the Fraser Institute was released during the course of this study. The survey was based on 111 responses by executives of senior and junior mining companies who rated different mining jurisdictions on several factors important to their investment climate. Included in the published results were several questions that reflect on environmental regulation. Relevant results are summarized below. In each case the percentage of respondents rating each factor as a strong deterrent to exploration is given:

- *Uncertainty concerning the administration, interpretation and enforcement of existing regulations.* No respondent named New Brunswick in this category, a distinction shared with Chile and Australia. Quebec and Manitoba were mentioned once each, Alberta and Saskatchewan twice, Ontario, Nevada, Alaska and Argentina three times. Compare this with British Columbia (73 times) and Wisconsin (83 times).
- *Environmental regulations.* New Brunswick joined Mexico, Chile, Argentina, Saskatchewan, Newfoundland, and Manitoba with no mentions. Again at the top was Wisconsin (86 mentions) followed by Montana (78) and British Columbia (74).
- *Regulatory duplication and inconsistencies.* At the bottom were Australia, Saskatchewan, Manitoba, and Alberta (all 0), followed by Ontario, Quebec, Nevada, and Chile (2 each) and New Brunswick (3).

In comparison with other jurisdictions, the Fraser Institute study gives New Brunswick good marks for regulation. This is encouraging. It needs to be remembered, however, that the study itself has some limitations. Of the 111 respondents, no information is available on how many have first-hand experience in the Province. To an unknown extent, the study may be measuring reputation rather than fact. Therefore, it would be unwise to rely exclusively on this endorsement.

Our study will tend to put more weight on the comments of individuals and organizations currently or previously active in New Brunswick. Industry comments recognized the desire of government officials for economic development, as well as a generally good relationship between industry and government. Nevertheless, the preponderance of their comments called for improvement in the regulatory apparatus.

- The creation of the Standing Committee on Mining and Environment (SCME) was commended. Industry recognized that the committee provides a useful forum within government and promotes balanced decisions. Still, several comments called for improvements in the way the Committee operates. Several called for the appointment of a "Mining Advocate" to assist industry to understand and meet the various requirements.
- A number of comments noted that a number of government agencies are involved in regulating industry. While improvements have been made in regulatory performance, some called for further streamlining of regulatory processes within the Province, as well as those involving the federal government. "While the relationship between New Brunswick and federal authorities seems more cooperative than in other jurisdictions, effective administration of approvals processes should not hinge on good will between regulatory authorities."
- Other comments included: a concern about delays involved in getting project approvals; the potential for further delays if public consultation is involved in renewals; and the occurrence of apparently unreasonable requests and behaviour by individual public officials.

Comments by government officials were substantially at variance with industry perceptions:

- The operation of the Standing Committee has been reviewed recently at the request of the NBMA. The Committee's terms of reference have been revised and forwarded to industry for comment. With respect to a "mining advocate", The Mines and Energy Development

Section of DNRE has as its mandate to facilitate the development of mining. It offers assistance to every proponent, while seeking solutions in the interest of the people of New Brunswick.

- Federal legislation is only rarely involved, and the SCME is unaware of any project being delayed by federal or provincial legislation within its purview.
- DNRE is preparing a document or guide to the mine approval process. It will set out requirements for a mine plan, reclamation plan and other parameters in an effort to dispel any misunderstandings and speed development.

Although New Brunswick has a good reputation among Canadian mining jurisdictions, industry comments indicate that the Province should not be complacent. There may be room for improvement in relation to the combined impact of federal and provincial environmental regulatory requirements. At the very least, the dichotomy between the regulatory situation as perceived by industry and that perceived by government calls for some resolution.

Policy implications

On the basis of our experience in several jurisdictions, we conclude that the complete harmonization, rationalization and integration of all federal and provincial environmental requirements would create a powerful incentive for mining companies to take a fresh look at doing business in New Brunswick. In our view, it would be appropriate for the Province to seek complete delegation of the operation and enforcement of federal regulations to the Province. It would also be appropriate for the Province to examine whether there is a need to streamline its own regulatory structure. We present these as observations rather than recommendations.

We further conclude that there is a need for improved communication between industry and government to attempt to resolve their differing views of the regulatory situation and the need for a mining advocate. We strongly suggest that senior management undertake an initiative along these lines.

Recommendation

5.1 Senior management of DNRE and other affected departments should meet with industry leaders to discuss any concerns with the regulatory climate in New Brunswick.

5.3 Exploration incentives

5.3.1 Introduction

Incentive programs represent one of four major levers that a government can employ to influence investment decisions in exploration and mining. The other three are the provision of geoscience information, maintenance of a hospitable regulatory climate, and appropriate taxation of mining profits.

This section of our report compares New Brunswick's incentive programs, which are designed to increase mineral exploration or promote other aspects of mineral development and production, with those of other Canadian provinces and territories. There are no federal incentive programs (as defined here).

The term "exploration incentive" refers to any financial incentives, such as government grants and other contributions, offered to prospectors and exploration organizations to stimulate mineral exploration. Tax incentives expressly designed to encourage mineral exploration also qualify. However, tax measures designed to promote non-exploration investment, such as processing allowances, are considered in another section, "Taxation". The identified exploration incentive programs are discussed below, and their main features are set out at the back of this section in Table 5.3, "Summary of Mineral Exploration Incentives."

A few jurisdictions, including New Brunswick, offer direct financial assistance for mining or processing activities beyond the exploration stage. Such programs may be said to influence exploration decisions, but only indirectly. A description of all identified incentive programs of this kind follows the discussion of exploration incentives. The main features of such programs are set out at the end of this section in Table 5.4, "Summary of Other Mineral Industry Incentives."

The costs of in-kind support for mineral exploration and development provided through geological mapping and other relevant government services are not included here. Table 5.1, "Cost of Mineral-related Incentive Programs" summarizes the available information on magnitude of these programs in different jurisdictions. See Appendix A for a description of the programs summarized here.

Table 5.1: Costs of Mineral-related Incentive Programs
Canadian dollars per year [1]

	Exploration	Other	Total	Rank	% of Total
Alberta	0	0	0	10	0.0
British Columbia	9,500,000	0	9,500,000	1	36.8
Manitoba	2,875,000	250,000	3,125,000	4	12.1
New Brunswick	390,000	100,000	490,000	6	1.9
Newfoundland [2]	1,500,000	250,000	1,750,000	5	6.8
Nova Scotia [3]	190,000	?	190,000	8	0.7
Ontario	4,000,000	0	4,000,000	3	15.5
Prince Edward Island	0	0	0	10	0.0
Quebec [2,3]	6,300,000	?	6,300,000	2	24.4
Saskatchewan	0	0	0	10	0.0
Northwest Territories [4]	159,000	0	159,000	9	0.3
Yukon [2,3]	378,000	?	378,000	7	1.5
Total	25,292,000	600,000	25,892,000		100

Notes:
1. Quoted dollar values are lower than actual in some cases because of missing data
2. Exploration incentive program(s) exist but cost data are not available
3. "Other" incentive program(s) exist but cost data are not available
4. Refers to 1998 data, prior to division into two territories

The provincial and territorial exploration incentive cost data are further placed in perspective in Table 5.2 by expressing them as a ratio of several relevant standards of comparison.

Table 5.2: Exploration incentive programs in perspective

	Incentive Program Costs $ X 10^3	Land Area (1) Km^2 X 10^3	Exploration Spending 1997 (2) $ X 10^6	Non-fuel Mineral Production 1997 (2) $ X 10^6	Exploration incentive costs in relation to: Land Area $/$Km^2$	Exploration Spending $/$10^3$ $	Mineral Production $/$10^3$ $
Alberta	0	642.3	21.55	516.21	0.000	0.00	0.000
British Columbia	9,500	925.2	91.15	1,940.06	10.268	104.23	4.897
Manitoba	2,875	553.6	34.17	1,020.57	5.194	84.14	2.817
New Brunswick	390	71.5	12.34	934.88	5.458	31.61	0.417
Newfoundland	1,500	373.9	49.38	1,008.27	4.012	30.37	1.488
Nova Scotia	190	53.3	6.52	220.49	3.562	29.15	0.862
Ontario	4,000	917.7	167.04	5,536.14	4.359	23.95	0.723
Prince Edward Is.	0	5.7	0.00	3.41	0.000	0.00	0.000
Quebec	6,300	1,365.1	155.43	3,437.05	4.615	40.53	1.833
Saskatchewan	0	591.7	43.88	2,092.10	0.000	0.00	0.000
Northwest Terr.	159	3,119.2	135.03	548.77	0.051	1.18	0.290
Yukon	378	474.4	36.93	203.63	0.797	10.24	1.856
Canada	25,292	9,093.5	753.40	17,461.57	2.781	33.57	1.448

Notes:
1. Source: Geomatics Canada. Land area does not include area covered by freshwater
2. Source: Natural Resources Canada

5.3.2 Discussion

Financial incentives offered by governments to encourage mineral exploration and development vary widely from jurisdiction to jurisdiction in Canada (see Table 5.1).

New Brunswick ranks 6th in dollars spent, and the amount of resources allocated to its incentive programs are far below the average for all Canadian jurisdictions. The total cost of its three incentive programs represents less than 1/4 of the average spending of all jurisdictions and accounts for less than 2% of incentive costs for all jurisdictions. If the full costs of incentive programs offered by other provinces and territories were available and recorded here, the New Brunswick proportion would be even smaller.

British Columbia provides the most generous financial incentives, followed by Quebec, Ontario and Manitoba. These 4 provinces each spend $2 million or more and together account for 89% of the total. The average cost per jurisdiction is $2.0 million. At the other extreme, Alberta, Prince Edward Island, and Saskatchewan provide no incentives (subsequent discussion and comparisons will omit reference to these three provinces).

A richer perspective is obtained if the costs of exploration incentives offered by different jurisdictions are placed in ratio to other relevant parameters, such as provincial land area, private-sector expenditures on mineral exploration, or the value of mineral production from the province. This type of comparison is shown in Table 5.2. Per square kilometre of land area, New Brunswick's spending on exploration incentives falls in closely with that of several other provinces (Manitoba, Newfoundland, Nova Scotia, Ontario, and Quebec). On this basis, British Columbia spends twice as much as these provinces, the Territories (NWT and Yukon) substantially less.

Per thousand dollars of private-sector exploration expenditures in the jurisdiction, New Brunswick spends about $28 on incentives, comparable with Newfoundland, Nova Scotia and Ontario. Quebec spends one-third more, while Manitoba and British Columbia spend over twice as much. Per thousand dollars of mineral production, however, New Brunswick is in the low end of the range. It offers only about 37 cents in exploration incentives, second-lowest only to the Northwest Territories. On this basis, British Columbia offers nearly $5, more than 10 times the amount offered by New Brunswick per thousand dollars of mineral production.

It would be appropriate for the Government of New Brunswick to review the Province's programs designed to stimulate the mineral industry, relative to those of other Canadian provinces. There is undoubted mineral potential in New Brunswick. However, it is an area which has been well explored by traditional methods (particularly in the Bathurst camp). Consequently, the existing potential is likely to be uncovered only by the deployment of more sophisticated and costly techniques. See the discussion of Deep Drilling in Section 3.8.

As well, production from major known metal deposits has begun to decline, and reserves have shrunk. In order to defend and sustain the value of existing industrial infrastructure, such as mills and smelters, new feed must be found. Increasing exploration effort is an obvious way to improve the probability of discovery.

For a graphic dramatic public policy response to a similar situation, consider the Quebec program of deep drilling in the Abitibi sub-province (another well-explored area). To offset declining reserves and discovery rates, Quebec is offering substantial assistance with the direct cost of drilling exploration holes, up to $50,000 per hole.

5.3.3 Comments and suggestions received

Some respondents believe that New Brunswick's exploration incentives are not competitive with those offered in other provinces. Suggestions for improvement included: adopting a "flow through" funding program; granting up to 20% of capital investment in a new mine; and introducing a refundable tax credit for all taxes payable under the Metallic Mineral Tax Act (MMTA) for direct drilling expenditures for seeking new minerals or to extend the life of a producing mine.

5.3.4 Policy implications

Table 5.1, and the comments of respondents, bring out the fact that New Brunswick offers very modest incentives relative to those of other provinces. Because parts of the Province are a mature exploration environment, it needs to try harder to capture the attention of explorationists. Since a relatively large proportion of the prospective land is held by producing companies, consideration should be given to offering an incentive program which would appeal preferentially to producers. We believe that recommendations made in Chapter 3 adequately address these issues.

Table 5.3: Summary of Mineral Exploration Incentive Programs

Jurisdiction	Name of program	Recipients	Program conditions	Cost/year
Alberta	**None**			
British Columbia	**Prospectors Assistance Program**	Qualified prospectors	Pays 75% of approved exploration program to a maximum of $10K, half up front, requires prospector to do minimum 30 days of work.	$500,000
	Mining Exploration Tax Credit	Eligible BC residents and corporations who conduct mineral exploration in BC	Refundable tax credit of 20% of net exploration expenditures.	$9,000,000
Manitoba	**Manitoba Prospectors Assistance Program**	Licensed prospectors	Pays 50% of eligible expenditures to a maximum of $7,500.	$125,000
	Mineral Exploration Assistance Program	Qualified individuals or companies who conduct mineral exploration in Manitoba	Pays 25% of approved eligible expenses to a maximum of $300K. For specified northern regions: 35%, maximum $400K.	$2,750,000
New Brunswick	**Mineral Exploration Stimulation Program**	Valid NB prospectors and exploration companies	Makes grants of up to $3,000 to support grass-roots exploration activities. Pays expenses such as meals, chemical analyses, mileage, etc., but excludes wages.	$40,000
	New Brunswick Exploration Assistance Program	Junior mining companies conducting mineral exploration in NB	Pays up to 50% of cost of approved projects: minimum payment $10K, maximum payment $40K.	$350,000

Table 5.3: Mineral Exploration Incentive Programs, continued

Jurisdiction	Name of program	Recipients	Program conditions	Cost/year
Newfoundland	**Prospectors Assistance Program**			N/A
	(a) Training	Would-be prospectors	Provides prospector training courses.	
	(b) Direct assistance	Eligible prospectors	Pays grants of up to $4K for eligible prospecting expenses.	
	Junior Company Exploration Assistance Program	Eligible individuals and junior companies	Pays up to 50% of approved eligible advanced exploration costs to a maximum of $100K per undertaking.	$1,500,000
Nova Scotia	**Prospector Assistance Program:**			
	(a) Training	Would-be prospectors	Provides funding for courses, seminars, workshops, field trips.	$20,000
	(b) Direct assistance	Prospectors	Pays up to $5K grant: recipient must contribute a further 30% of grant amount.	$140,000
	(c) Marketing	Prospectors	Pays up to $1,600 to help prospectors promote their properties to junior and senior companies.	$30,000
Ontario	**Ontario Prospectors Assistance Program**	Qualified prospectors (individuals)	Pays grants of up to $15,000 per year. Not conditional on any prospector contribution.	$4,000,000
PEI	**None**			

Table 5.3: Mineral Exploration Incentive Programs, continued

Jurisdiction	Name of program	Recipients	Program conditions	Cost/year
Quebec	**Flow-through Shares**	Individual Quebec taxpayers investing in shares of a non-producing company	Allows a deduction of 125% of exploration expense against Quebec income tax. Deduction rises to 175% for surface exploration. For investors with taxable income over $60,000, governments bear 72% of cost.	Not available
	Quebec Mineral Exploration Assistance Program **Part A: for prospectors**	Individual prospectors or groups of individuals	Pays up to $4K per year for basic prospecting expenses of which $1K is reserved for professional geological fees. A two-prospectors group may receive $8K. Advanced exploration project may receive $15K.	$1,400,000
	Part B: for companies	Companies operating anywhere in Quebec except for Near-North region	Refunds 50% of approved exploration expenses, max $50K per year. Project must be submitted by a P.Geo. Underground exploration is excluded.	$1,600,000
	Part F: Native Mining Entrepreneurship Development	Aboriginal communities	Creates cost-shared mineral exploration funds in Aboriginal communities to encourage participation in mineral resource development. Supports outreach, training, prospecting and exploration, creation of exploration companies. May pay up to $300,000 per fund per year.	$900,000
	Near-North Mineral Exploration Program	Companies operating in the Quebec Near-North	Refunds up to $100K of exploration expenses carried out in the region.	$1,100,000

Table 5.3: Mineral Exploration Incentive Programs, continued

Jurisdiction	Name of program	Recipients	Program conditions	Cost/year
	Deep Drilling in the Abitibi Region	Mining companies having well-defined targets	Pays 50% of actual and approved drilling costs for exploration holes longer than 400 metres (75% for portion > 1,000 m). Maximum grant is $50K.	$1,300,000
Saskatchewan	**None**			
Northwest Territories	**Prospectors Grubstakes Program**	Qualified prospectors	Pays up to $8K per prospector to offset field expenses. Recipients must submit reports and expense claims.	$75,000
Nunavut	**N/A**			
Yukon	**Yukon Mining Incentive Program**			$378,000 (Total of a, b, c)
	(a) Grassroots Prospecting	(a) Qualified prospectors	(a) Pays 100% of basic operating expenses, maximum of $10K.	
	(b) Grassroots Grubstake	(b) Companies or individuals who finance other prospectors	(b) Pays 75% of approved expenses up to $10K per prospector.	
	(c) Target Evaluation	(c) Individuals, partnerships or companies	(c) Pays 50% of approved expenses related to basic exploration work directed to economic evaluation of target occurrences.	
	Yukon Mineral Exploration Tax Credit	Eligible individual or company taxpayers	Refundable tax credit of 22% of qualifying exploration expenditures for off-minesite exploration.	Not available

Table 5.4: Summary of Other Mineral Industry Incentive Programs

Jurisdiction	Name of program	Recipients	Program conditions	Cost/year
Manitoba	**Specialty Minerals Incentive Program**	Companies	Pays up to 30% to maximum $50,000 to assist companies to evaluate economic potential of "specialty" mineral deposits. Includes field, technical, marketing studies.	$250,000
New Brunswick	**Value-added Mineral Processing Program**	Private sector holders of mineral rights, others in the mining industries, or certain public agencies	Pays up to 50% of project costs to maximum $30,000 per project, minimum $5,000. Covers projects designed to improve recoveries or create value-added products, thus enhancing the value of mineral resources.	$100,000
Newfoundland	**Dimension Stone Incentive Program**	Companies involved in quarrying	Pays up to 50% of eligible costs, maximum $50,000 per project for quarry, infrastructure or plant development for dimension stone projects.	$250,000
Quebec	**Assistance for Bringing an Orebody into Production Program**	Small and medium-sized companies with a promising orebody, seeking major investment from financial institutions	Pays up to 12% of projected capital cost, maximum $3 million, to assist with costs of preparing detailed submissions to meet due diligence requirements prior to investment in company shares by a financial institution. Refund is paid after the financial institution invests.	Not available
Yukon	**Energy Infrastructure Loans for Resource Development Program**	Companies requiring energy infrastructure to support resource development	Provides loans for capital infrastructure projects at subsidized interest rate (prime less 3/8 percent).	Not available

5.4 Processing Technology Incentives

In large part, the discussion of incentives for encouraging processing of minerals has been worked into Section 4.6 of this report, entitled "Processing Technologies Assistance." A few words may be appropriate here on how the New Brunswick Value Added Mineral Processing program (VAMP) stacks up against similar programs in other provinces. Table 5.4 (preceding page) describes the main features of VAMP and other incentive programs of several jurisdictions. Two programs in particular, those of Manitoba and Newfoundland, are of interest. They support industrial minerals producers in evaluating processing options. These programs are described further below.

Manitoba. *The Specialty Minerals Incentive Program (SMIP)* is a new two-year incentive program offering financial assistance of up to 30% of approved eligible expenditures to a maximum of $50,000 per recipient, per fiscal year, to assist companies to evaluate the economic potential of existing non-fuel specialty mineral (mainly industrial minerals) deposits and market those resources more effectively. Eligible expenses may include consultant contract fees for the preparation of marketing studies, process flowsheets or business plans, definition drilling, geochemical analysis, bulk testing, beneficiation and metallurgical studies related to the testing of the commodity and certain administrative costs. Minerals that are not eligible under the program include aggregates as they pertain to construction, base and precious metals, oil, and natural gas. A sum of $250,000 is allocated annually over a two-year fiscal period to March 15, 2001.

Newfoundland. *The Dimension Stone Incentive Program* provides up to $250,000 annually in support of 50% of approved, eligible costs, to a maximum of $50,000 per project, for quarry, infrastructure and plant development for dimension stone projects.

Policy implications

On a superficial examination, it would appear that New Brunswick's support of technology development initiatives is minimal by comparison with that of two other provinces of comparable size. However, existing VAMP funds are not over-subscribed. The limiting factor in the use of VAMP is that too few ideas are coming forward. Recommendations made in Chapter 4 for a series of seminars to raise private-sector interest in dealing with New Brunswick's technology needs address this issue, and no additional recommendations are offered here.

5.5 Taxation and tax incentives

5.5.1 Introduction

This section discusses the taxation of operating mines and mining companies and assesses the taxation regime of New Brunswick in relation to those of other jurisdictions. For a discussion of taxation provisions related to mineral exploration, see Section 5.3, "Exploration Incentives." For a discussion of non-profit-based taxes, charges and levies, see Section 5.6.

The mining industry is subject to federal income tax, provincial income tax, and provincial mining taxes / royalties. For the territories under federal jurisdiction (Northwest Territories, Nunavut and Yukon) the federal government exercises province-like jurisdiction over natural resources and levies both income tax and mining taxes / royalties. Mining taxes and royalties are designed to ensure that the people receive a fair return for the use of publicly-owned resources.

5.5.2 Mineral taxation in New Brunswick

In New Brunswick, the operator of a metal mine is liable for mining taxes levied under the Metallic Minerals Tax Act, which imposes taxes on a two-tier system. A 2% royalty is based on the "net revenue" of a mine after the second year of commercial production, consisting of gross revenue less transportation, processing and handling costs plus an allowance for return on processing assets. The mine also pays 16% of net profits in excess of $100,000 (net profit is calculated after deduction of operating costs, the 2% royalty, wages, milling and smelting costs, and overhead such as depreciation, administration and exploration allowance).

Operators of non-metal mines pay royalties. For potash, these are currently 6.25% of the sales revenue fob mine. For peat and other non-metallics, levies are made under the provisions of the *Quarriable Substance Act*. In this case, the amount of royalty paid is proportional to the quantity produced (e.g., 8 cents per bale of peat, 25 cents per tonne of sand and gravel, 16 cents per tonne of coal).

5.5.3 Competitive assessment

Our analysis of tax competitiveness deals essentially with metallic minerals. To attract mining investment, any province must ensure that its taxation regime is competitive with that of other provinces. An attractive mining taxation system will also need to take the fundamental characteristics of the mining industry into account (high risk, cyclical, dependent on global markets, price taker, capital intensive, often operating in remote areas, finite life of any orebody). It will also respect other criteria (stable over time, transparent, level playing field for all corporations, easy to understand, easy to administer).

The activities of Canadian mining companies in other countries have been expanding rapidly. The global system for the production of metals and minerals is now tightly integrated. Thus, it is no longer sufficient for New Brunswick to compare itself against other Canadian jurisdictions. Rather, its policies must stand up against those of Australia, Brazil, Chile, ... Ireland ... Zimbabwe (indeed the whole alphabet of countries).

5.5.4 Methodology for assessing tax competitiveness

The analysis of taxation competitiveness could proceed in several different ways:

- review of legislated taxation provisions;
- comparison of income and mining tax rates;
- dynamic financial models that compare different tax systems as applied to typical mines and deposits over their entire life cycle;
- review of comments made by other observers and interviewees.

Legislative provisions

One can compare the design features of different taxation regimes across Canada and in foreign countries. Periodically, the larger Canadian tax consultants issue international comparisons of mining taxation legislation. One such report, by the PriceWaterhouseCoopers Global Mining Group (1998) compared the provisions of the Canada / Ontario tax regime with those in Australia (Western Australia), Argentina, Bolivia, Botswana, Brazil, Chile, Guyana, Indonesia, Mexico, Peru, South Africa, Suriname, USA (Colorado), Venezuela and Zimbabwe. It was appropriate to select

Ontario to represent Canada because it is Canada's largest mining province and because its mining tax provisions are reasonably representative of those of several other provinces.

This qualitative comparison turned up some interesting findings:

- Canada and Zimbabwe allow a new project to recover capital costs before paying income tax.
- Early return of capital is offset at least partially in Canada's case by relatively high tax rates on mining income.
- Mexico and Chile levy no mining tax or royalty.
- Western Australia, Botswana, Brazil, Chile, Guyana and several other countries have no state income taxes.
- Some countries, notably Indonesia, incorporate the tax rate in a bilateral agreement between the government and the mining company, whereas other countries (Guyana for example) have a hybrid regime involving both general provisions and project-specific terms.
- Some jurisdictions (including most Canadian governments) base their take entirely on profits: no profits, no tax. Others collect a royalty at all times whether the mine is profitable or not.
- Most countries recognize the cyclical nature of mineral revenues by providing generous loss carry-back or carry-forward provisions to smooth the tax bite.

Interesting as they are, these anecdotal indicators do not tell us much about the overall tax load carried by a mine in one country as opposed to another. One would have to work through a few actual or hypothetical projects in order to identify which regime is the most attractive.

Comparison of tax rates

Within Canada, the structural variation is much smaller. All mining companies are subject to the same federal income tax rules. As well, most provinces base their corporate income taxes on the federal tax base. Most provinces levy a profits-based mining tax (sometimes called a royalty or royalty tax) based on "resource profits" (New Brunswick is one of the two provinces to collect a royalty that is independent of profit level). As a result of these similarities, it is fairly common for analysts to compare the tax load in different jurisdictions by simply noting the differing statutory tax rates of provincial income tax and provincial mining tax. Or they may use the "marginal" tax rate, normally the highest combined rate (i.e., the rate that applies to the last dollar of income).

Notwithstanding the basic similarities among these provincial tax structures, some differences exist in their details. The definition of resource profits may differ; interest paid may be an accepted deduction in one province but not in another; "net smelter return" may have differing definitions, and so on. Therefore, comparisons made by these simple comparisons of statutory or marginal tax rate are inexact.

Nevertheless, on a relative basis, and over time, a decrease in a province's mining tax rate can certainly indicate that it has become more attractive than it was earlier, and relatively more attractive than "competing" provinces. This conclusion assumes that the structure of the tax has not changed appreciably at the same time. We will therefore review available data on the changes in provincial mining tax rates over time as one indicator of trends in New Brunswick's tax competitiveness.

Modelling of hypothetical mining projects

Most analysts agree that comparisons of two or more mineral taxation regimes are best made by applying their rules to a financial model of a single hypothetical mine placed in the different jurisdictions. These models are dynamic, in the sense that they follow a hypothetical mine from the exploration phase, through several years of production, and then through final closure and reclamation. The tax regimes combine (for Canada) federal and provincial income taxes and provincial (or equivalent) mining taxes and royalties. Models of foreign tax regimes include analogous components.

This methodology was first used for policy purposes in Canada during the early-to-mid-1970s to resolve an intergovernmental dispute over resource taxation. Until 1972, provincial resource taxes paid by a company were deductible from its federal income tax. When Alberta dramatically increased oil royalties, the federal government moved to protect its tax base by disallowing provincial resource (including mining) taxes as a deduction against income tax. In order to find a way to deal with the consequent squeeze on mining companies, a federal-provincial-industry modelling project was undertaken. Mining companies made available financial models of (thinly-disguised) actual mines, and these were subjected to taxation rules under the "old" scenario, the "new" scenario and several hypothetical scenarios. The dispute was resolved when provinces agreed to cap their royalties or resource tax rates. While resource taxes remained non-deductible

at the federal level, the federal government agreed to ease the burden on mining companies by creating the 25% resource allowance.

Natural Resources Canada has developed this methodology further and has applied it to the periodic analysis of the tax loads imposed by various Canadian and foreign governments. The indicator arising from the analysis is the "average effective tax rate" over the life of the project. The results have been published in government reports and in journals. The most recent publication is based on all jurisdictions' tax rules as they were in 1994. A new study is in preparation, but it will not appear until March 2000.

A somewhat similar approach was taken by Ernst and Young in a March 1994 study prepared for New Brunswick. The study compared the combined income and mining tax load for a hypothetical base metal mine if it were placed in New Brunswick vs Quebec, Ontario, or Manitoba.

Comments and opinions

In the course of this study we reviewed several earlier documents that contained comments or opinions relevant to the subject. We also interviewed a large number of people familiar with mining taxation in New Brunswick and elsewhere. The opinions and suggestions thus received form an additional input to our conclusions and recommendations.

We will base our analysis and conclusions primarily on three sources:

- NRCanada's 1994 average effective tax rate comparisons across provinces and countries;
- available information on later trends and changes in provincial mining taxation, as obtained from provincial budgets of recent years;
- comments and opinions received.

5.5.5 New Brunswick's competitive position in 1994

Table 5.5 is adapted from charts provided by Natural Resources Canada. The tax burden of different jurisdictions is measured in terms of the average effective tax rate over the life of a base metal mine. All Canadian provinces and territories are tested and ranked against Australia (New South Wales, Queensland, South Australia and Western Australia) Brazil, Chile, Indonesia, Mexico,

and the USA (Alaska and Nevada). Two levels of profitability are tested to determine whether the relative ranking of different tax regimes changes with profitability.

Table 5.5: Average effective tax rates for base metal operations[1] in different jurisdictions
(Total of income and mining taxes / royalties: percent of pre-tax profits)

10% Internal rate of return			25% Internal rate of return		
Jurisdiction	**Rank**	**AETR[2]**	**Jurisdiction**	**Rank**	**AETR[2]**
Brazil	1	55	Brazil	1	50
Western Australia	2	48	Mexico	2	44
Queensland	3	48	**Ontario**	3	43
Mexico	4	46	**New Brunswick**	4	41
New South Wales	5	44	**Alberta**	5	40
Indonesia	6	43	**Nova Scotia**	6	39
South Australia	7	38	**British Columbia**	7	39
Arizona	8	38	Indonesia	8	38
Nova Scotia	9	34	Western Australia	9	38
British Columbia	10	32	Queensland	10	38
New Brunswick	11	32	**Manitoba**	11	37
Chile	12	31	**Yukon**	12	37
Ontario	13	30	New South Wales	13	36
Manitoba	14	29	**Quebec**	14	35
Alberta	15	29	South Australia	15	34
Nevada	16	28	Arizona	16	33
Alaska	17	28	Chile	17	32
Yukon	18	27	**N.W.T.**	18	30
Newfoundland	19	26	**Newfoundland**	19	29
N.W.T.	20	19	Alaska	20	28
Quebec	21	18	Nevada	21	27

Notes: 1. Mine life of 10 years; discount rate 7.5%; revised for tax changes as of April 1994.
2. AETR = Average effective tax rate over the life of the mine

Source: After Minerals and Metals Sector, Natural Resources Canada

For a mine which is marginally profitable (10% pretax rate of return), the tax burden for most Canadian jurisdictions falls in the lower end of the ranking, as do Alaska, Nevada and Chile. Quebec is the lowest of all jurisdictions studied and Brazil the highest. New Brunswick falls in the middle of the list, above 7 other Canadian jurisdictions and Chile but below Nova Scotia and British

Columbia. The average effective tax rate ranges from approximately 18% for Quebec to 55% for Brazil, with New Brunswick falling at 32%.

In the case of a highly profitable mine (25% pretax rate of return) several Canadian provinces move towards the top of the ranking. In this array, Nevada is the lowest and Brazil the highest. New Brunswick is fourth highest overall, following Brazil, Mexico and Ontario. All 8 remaining Canadian jurisdictions are lower than New Brunswick. The average effective tax rate ranges from 27% for Nevada to 50% for Brazil, with New Brunswick coming in at 41%.

The results of the Ernst and Young study agree in some respects with those of NRCanada. Quebec has the lowest tax burden and New Brunswick the second-highest. However, the relative rankings of Manitoba and Ontario are reversed. The two studies differ in their assumptions and methodology. Ernst and Young used the hypothetical financial model of a large mature base metal mine and placed it within the tax regimes of four provinces. They calculated the combined tax load at one moment in time, year 11 of the mine's life. Under these assumptions, Manitoba ranks as the jurisdiction with the highest combined tax burden, followed by New Brunswick and Ontario. Quebec has the lowest combined tax burden.

From the modelling evidence, we conclude that in 1994 New Brunswick was certainly among the higher-tax regimes in Canada and (for highly-profitable mines) in the world.

5.5.6 Changes in New Brunswick's relative position since 1994

New Brunswick has not changed its mining taxation regime in a major way since 1978, although minor changes have been made to encourage further processing. However, several other provinces and/or territories have made significant changes in their mining tax arrangements. As well, some provinces have introduced changes in income tax and capital tax rules that affect mining.

Following is a partial list of significant tax changes tabled by Canadian jurisdictions in recent budgets (this list does not include changes to incentive programs or to non-profit taxes and charges, both of which are considered elsewhere in this report):

- Nova Scotia introduced a capital tax of 0.25% on large corporations. It also introduced an input tax credit under the HST (budget of April 17, 1997). It announced later that the capital tax would be eliminated after 5 years.
- New Brunswick introduced similar measures affecting capital tax and HST (December 10, 1996).
- Under the Mining Duties Act, Quebec introduced an additional depreciation allowance of 15% of the capital cost of major new assets to be used in processing ore (March 25, 1997).
- Ontario Corporations will be allowed a 20% refundable tax credit for R&D expenses incurred in an eligible Ontario institution (university, etc.) (May 6, 1997).
- Manitoba increased the exemption amount for capital tax from $2 million to $3 million (March 20, 1997).
- Alberta phased out the property tax on machinery and equipment and the establishment of a new, attractive generic royalty system for oil sands production (April 21, 1997).
- British Columbia extended the "new mine allowance" (an additional deduction of 1/3 of the capital costs of new mines) for an additional 10 years for mines that begin production before January 1, 2000 (March 30, 1998).
- Manitoba increased the capital tax exemption from $3 million to $5 million (March 6, 1998).
- Quebec increased its additional exploration allowance (for certain regions) from 50% to 75% and allowed operators without mining duties payable to transfer this amount to a refundable credit. It also increased the deduction for exploration expenses (for certain regions) by an additional 25% of the expenses. As well, an additional allowance for tailings treatment will be allowed under the Mining Duties Act. (March 25, 1998). Quebec offers a mining tax holiday of 10 years for a new mine located above 55° N.
- Saskatchewan announced a number of changes to its potash royalty regime, reducing the profit-related component of the tax and freezing the fixed royalty component (removing it from inflation adjustment). As well, beginning in 2002 taxes will be assessed on a consolidated basis rather than a mine-by-mine basis (March 19,1998).
- Manitoba reduced its mining tax rate from 20% to 18% of mining profits (April 29, 1999).
- Ontario will increase exemptions for capital tax to $4 million by 2003 (1999).

Although this list of taxation changes affecting mining is partial, the weight of evidence suggests that other provinces have tended to move in the direction of reducing tax levels rather than raising them. For example, Quebec, Saskatchewan, Manitoba and British Columbia have all made

changes to reduce the tax burden on mining. We found no instance of an increase in any Canadian province or territory jurisdiction. It is beyond the scope of this study to review changes in other countries' taxation regimes.

On the basis of these favourable changes in competing jurisdictions, we conclude that, if anything, New Brunswick has lost ground in terms of tax competitiveness since 1994 and remains one of the higher-tax jurisdictions.

5.5.7 Comments and opinions received

In 1999, for the third year running, the Fraser Institute carried out a survey of mining companies operating in Canada to assess how perceived mineral potential and various public policy factors such as taxation and regulation in different jurisdictions affect mineral exploration decisions. Jurisdictions tested include all Canadian provinces and territories, eighteen U.S. states, Argentina, Australia, Chile, Mexico and Peru. The survey went to 422 senior and junior mining companies, of which 111 or 26% responded. Respondent companies' exploration expenditures totalled over $857 million (1998). The portion spent in Canada accounted for some 43% of the estimated Canadian total (35% for the USA). One question asked whether the taxation regime in each jurisdiction constituted a strong deterrent to exploration. New Brunswick was one of only two Canadian provinces and 8 jurisdictions for which not a single respondent said "yes." New Brunswick scored highest of all jurisdictions in the overall rating of policy attractiveness.

Tax experts from the federal government and mining companies made the following points to us:

- Canadian mining taxation is complex. The presence of a flat royalty in New Brunswick adds to the complexity. A flat royalty can raise the cut-off grade, it falls most heavily on unprofitable mines, and it interacts in unpredictable ways with other tax features.
- The overall level of mineral taxation is higher than in most other provinces. Small companies in particular find the Province's system troublesome.
- Suggestions included: giving a refundable tax credit for prior exploration expenditures to offset capital costs for a new mine; giving a refundable tax credit for incremental exploration expenditures to preserve the life of an existing mine; modifying the taxation system to help

offset growing legislated costs; eliminating the capital tax as in Nova Scotia; eliminating the flat royalty.

5.5.8 Tax Incentives

Notwithstanding the fact that New Brunswick's mineral taxation burden is near the high end of the Canadian spectrum, it should be remembered that there are some built-in incentives. For example, 150% writeoff is given for exploration expenditures incurred by a profitable mine. As well, the two-year tax holiday under MMTA provides an opportunity for the operator to recover some or all of its capital before becoming taxable.

The authors have been assured that these features are built into the methodology (specifically, the mine and tax models) used by Natural Resources Canada. Net of these incentives, New Brunswick is near the high end of Canadian jurisdictions with respect to mineral taxation burden.

5.5.9 Policy Implications

It is difficult to escape the conclusion that New Brunswick's mineral tax system needs an overhaul. On that basis we offer the following recommendations.

Recommendations

5.2 New Brunswick should review the *Metallic Minerals Tax Act* with a view to eliminating the royalty provision and making the overall tax burden more competitive with other provinces.

5.3 New Brunswick should review the Capital Tax with a view to eliminating it when the financial position of the Province permits.

5.6 Non-profit taxes, levies and charges

5.6.1 Introduction

To an increasing degree governments have been financing their operations through the imposition of payroll taxes, user fees and other charges unrelated to profit. As well, the regulatory burden has

increased as governments have introduced new layers of legislation to influence the practices of private-sector entities (notably in the environmental field: see the section on "Regulation").

The costs thus imposed by government (often called "mandated costs") fall on companies whether they are making a profit or not. As a result, they raise the survival hurdles for a company by increasing the basic cost of doing business. Whereas a company can control input costs such as labour or raw materials by increasing productivity or introducing new technology, a company's management can do little to control government-imposed costs.

This cost burden is inflicted by both the federal and provincial levels of government. In many cases, user fees and charges came into being to assist in deficit-fighting by creating new sources of revenue. According to a study by the Alliance of Manufacturers and Exporters, there are now 43 federal departments and agencies levying fees under cost recovery programs. The same trend is evident within provincial governments.

5.6.2 Examples of government charges

Some examples of federal charges having an impact on mining:

- marine services fees, recovering Coast Guard costs for navigational aids and ice breaking;
- employment insurance premiums, bearing in mind that some of the programs financed under EI are social programs and not strictly insurance-related;
- fees for nuclear regulatory approvals under the Atomic Energy Control Board of Canada;
- excise tax levied on transportation fuel;
- monitoring and compliance costs created by duplication between federal and provincial environmental regulations.

At the provincial level, too, user fees and charges have increased. For example, fees for obtaining provincial Certificates of Approval have increased dramatically since the mid-eighties. According to the NBMA, fees of up to $3,000 were introduced in 1993, and then increased by a large percentage (a factor of ten or more in some cases) in 1998. Provinces also levy taxes on motor fuel and other essential inputs to mining.

5.6.3 Comments and opinions received

Relatively few respondents commented on mandated costs in this study. Their views, however, were consistent with the representations made by mining industry spokesmen to governments over the last decade:

- User fees, cost recovery initiatives, payroll taxes and other mandated costs increase the uncontrollable costs of doing business (job-killers). Since the mining industry is a price-taker, to survive a company must reduce other costs, including wages.
- While user-pay is a justifiable principle, cost recovery should be imposed only after assuring that the levy is actually a fee for (necessary) service and all steps are taken to streamline the process. User fees and permits are getting prohibitively expensive. Reclamation and environmental bonds, lease costs and other legislated costs must not be a detriment to mine openings.

5.6.4 Summary and conclusions

For a cyclic industry such as mining, government-mandated costs are a serious problem. Imposing a cost burden which is insensitive to profit levels has the effect of making a mining operation vulnerable to premature closure in the trough in a price cycle. Not only does this create problems for shareholders, it also reflects on the security of workers and mining communities by making employment less stable. Moreover, it has the effect of raising the cut-off grade (the lowest percentage of contained metal that allows a tonne of ore to be mined profitably). This in effect reduces the ore reserve and shortens the life of the mine. It also means that some once-promising deposits may never be mined.

For these reasons, mining industry associations have long deplored the growth of government-mandated costs. A few studies have tried to estimate the extent of this burden and its trend over time. Because of varying definitions there is no agreed measure of the extent of the burden imposed by mandated costs. However, a knowledgeable official of the federal government recently estimated that for a mining company the combined burden of non-profit-related mandated costs (including municipal taxation) is not less than the combined burden of income and mining taxes.

By vastly increasing charges and fees of all kinds on business, governments have been able to find new sources of revenue to fight their deficits. This has allowed a degree of stability in personal and corporate income tax rates, and it has obvious political appeal. While accepting the necessity of a return to fiscal responsibility, however, we believe that the emphasis on non-profit charges has had very serious implications for the goods-producing sector.

Those industries which are compelled to move large quantities of physical product, or which require large physical inputs of raw materials or energy, have suffered relative to those selling an intangible product such as services or software. It is appropriate to celebrate the success of the "new economy", but we must remember that large numbers of Canadians still depend on the resource sector and other goods-producing industries. In particular, the highly volatile nature of mineral and metal prices makes the mining industry vulnerable to this policy.

We conclude that if the emphasis on non-profit-related costs continues, it will foreclose some future mineral development opportunities. Every effort should be made to reduce this dead-weight burden on the resource sector through cooperative efforts by mines ministers and their cabinet colleagues responsible for other resource sectors, at both the federal and provincial levels of government.

Recommendations

5.4 As deficits are eliminated, the Province of New Brunswick should review its own mandated non-profit charges, fees, levies and taxes to ensure that they do not constitute a barrier to mining investment or a threat to the continued productive life of existing mines.

5.5 The Minister of Natural Resources and Energy take a leading role within the network of federal and provincial mines ministers to ensure that this issue is resolved. The federal-provincial network of ministers of agriculture, industry and finance should also be involved.

5.7 Reclamation securities

5.7.1 Introduction

In a perfect world, it would be possible to open, operate, and close a mine with minimal impact on the environment. While this ideal is rarely realized in practice, effective mine reclamation can assist in restoring or reversing earlier environmental damage and leaving the site in a harmless condition.

In some cases, however (for example when acid rock drainage is present), it is not always possible to effectively restore the site and walk away. There is now a good scientific understanding of the processes at work, but universal technology for restoring the site in such a way as to completely prevent residual environmental impacts is still lacking, and long-term site care is the only option for some mine sites.

Some respondents to our survey have stated that long-term care is an interim measure, not a solution. It is certainly true that effectively monitoring the site and ensuring that earthen structures remain sound and that water treatment plants continue to function is no small task, especially where a time frame of a century or more is involved. In this view, new technology is urgently needed to allow a walk-away solution. For several years, the federal government, industry, and several provinces, including New Brunswick, undertook a cooperative research program to understand the phenomenon of acid drainage and find long-term solutions to it. The topic of environmental technologies is discussed in another chapter.

To the extent that future sites require long-term care, the financial resources needed to finance it will be substantial, and the relevant time frame may well exceed the expected life span of a typical mining company. Historically, too, many mine sites have not been adequately restored, either because legislation did not require it, or because companies failed prematurely. In these orphan sites, government has been left with the cost of carrying out reclamation work or financing long-term care. In seeking effective ways to avoid these problems in future, governments in Canada and elsewhere have imposed a legal requirement for reclamation and for the deposit of adequate financial security to guarantee reclamation.

New Brunswick has been in the forefront of jurisdictions in dealing with the scientific and policy issues associated with reclamation and reclamation securities. The Province has taken a proactive policy stance, requiring progressive engineering measures for acid drainage control and reclamation from the beginning of mine design. Right at the start, DNRE hands the operator a copy of New Brunswick's "Principles of Reclamation":

1. The objective in developing a mine reclamation plan shall be to achieve a "walk-away" state.
2. A mine reclamation plan shall attempt to return disturbed areas back to a state equal to or better than the original.
3. A mine reclamation plan shall be designed to permit ongoing or progressive reclamation where possible.

These objectives are intended to form the basis for developing the plan. If they turn out to be unattainable in practice the impact of this will be taken into consideration when an approval is considered. DNRE considers that this approach is successful in practice. One recent mine (the Restigouche mine) submitted a "walk-away" reclamation plan and has very tight environmental controls to ensure acid drainage does not get out of control.

In order to discuss financial security, the topic at hand, we must deal with several related issues:

- to what technical standard (degree of perfection) should the site be reclaimed?
- what policies and regulations will best ensure that sites are adequately restored?
- how should the necessary work be staged and financed?

These all have a bearing on reclamation security: ensuring that necessary funds will be available when needed.

5.7.2 Standard of reclamation

If a layman were asked to define an ideal standard for mine reclamation, he would be likely to say, "Put it back as it was." Professionals in the field accept that this is not a realistic standard, except in special cases such as small excavations or the strip mining of shallow bedded deposits. Some governments, including New Brunswick, require the land to be returned to an "original or better"

condition, or to a "productive" use. Other terms sometimes applied are "safe, stable and productive".

The Whitehorse Mining Initiative Leadership Accord established a visionary but practical objective for mine reclamation:

> *To ensure that comprehensive reclamation plans that return all mine sites to viable and, wherever practicable, self-sustaining ecosystems are developed, and are adequately financed, implemented, and monitored in all jurisdictions.*

Most mining legislation in Canada does not specify the required standard. It simply says that mine reclamation must be carried out. In many cases, as in New Brunswick, a reclamation plan or program must be submitted and it must be approved by the Minister. If officials judge that the degree of environmental protection built into the plan is inadequate, the plan is not approved. Normally, the plan and/or the approval document will set quality criteria (air and water emission limits, for example) that the site must maintain after reclamation.

The purpose of this discussion is not to suggest any particular standard. Rather it is simply to note that the technical standard required may have much to do with the cost of reclamation or the necessity for long-term care, thus affecting the amount and form of reclamation security that is required.

As well, it should be noted that a clear statement of reclamation standards is an important element of an attractive investment climate. Ideally, reclamation standards would be stable over time. Uncertainty as to the expected standard of reclamation can be a deterrent to exploration and development. Industry does not like surprises.

For standardized, low-impact activities such as grass-roots surface exploration, guidelines can be provided which specify measures to be taken to protect the environment. New Brunswick has such guidelines, a set of "Standard Conditions for Mining Exploration Projects" which provides some guidance. The only reference to site reclamation is a provision that trenches and settling ponds must be backfilled, covered with topsoil and seeded. These guidelines should be reviewed periodically to ensure that their reclamation requirements are realistic and to ensure they fit current

needs. For more intrusive activities such as advanced exploration requiring bulk samples, permits are required.

Through its "reclamation objectives" quoted above, the Province ensures that as much clarity as possible on reclamation expectations is provided to operators in advance. This has two beneficial effects. First, it allows the project to be designed with reclamation in mind, thus maximizing the effectiveness of reclamation and minimizing reclamation costs. Secondly, it assists in gaining expeditious project approval. Assessment and approval processes are streamlined by providing appropriate guidance to proponents as to the government's expectations regarding design parameters for progressive and final reclamation.

5.7.3 Reclamation policies and regulations

All Canadian jurisdictions effectively require site reclamation upon mine closure. In the last decade all provincial governments have rewritten their mining laws to require reclamation planning at the very beginning of a mine's life and the accumulation of funds to ensure that the plan will be carried out. Ontario was the first to publish a new act, followed closely by Saskatchewan and other provinces. Ontario is unusual in that its act has now gone through a second iteration and incorporates some reclamation provisions which are unlike those of other provinces.

New Brunswick's Mining Act is fairly typical in that it provides as follows:

- the Minister may require the operator to file a mine plan and reclamation program before the land is disturbed for exploration or mining;
- the Minister may require a security to be deposited to cover the cost of reclamation (the statutory amounts stated in the Regulations are quite small, but under Section 111.1 of the Mining Act the Minister has total discretion in specifying the amount of security demanded);
- the statutory forms of acceptable security may be cash, a negotiable bond signed over to the Province, an irrevocable letter of credit, or a bond of an insurance company (again note that under Sec. 111.1 the Minister has total discretion over the form of security);
- the work may not commence until the Minister has approved the reclamation program and the security has been deposited.

The main difference between the New Brunswick Act and those of other provinces is that most mining acts clearly make the operator responsible for reclamation, whereas New Brunswick appears to leave this requirement to the discretion of the Minister (sections 109, 110, 111, 111.1).

It is the case that in processing relevant permits and applications for physical work, officials do require operators to provide appropriate financial surety. For example, when an exploration program is conducted on private land and the landowner cannot be contacted or is not amenable to negotiating compensation, DNRE requires the posting of $1,000 plus $100 per claim per affected landowner. The absence of a mandatory reclamation requirement in the Act may therefore be considered a small gap, as it is very unlikely today that a Minister would consider allowing advanced exploration (e.g., the taking of a bulk sample) or a mining project to proceed without imposing a reclamation program and security.

One way to reduce uncertainty and attract investment would be to clarify the government's reclamation expectations in a little more detail, regarding both the technical standard of reclamation which will be considered acceptable, and the form and amount of financial security that may be required. The Act and Regulations are silent on the technical standard required. As to security, Section 111.1 of the Mining Act gives the Minister unlimited discretion to require any form and amount of reclamation security.

Some potential investors may feel ill at ease with these open-ended authorities. The authors believe that a public statement or policy should be considered setting out the criteria and decision rules the Minister will employ in establishing what constitutes an appropriate reclamation program and an acceptable financial security. We understand, from discussions with government officials, that a publication or guide to mine development requirements (including reclamation) is in preparation. We applaud this initiative.

The revised Ontario Mining Act has a variation on the approval of reclamation plans or programs. In response primarily to fiscal constraints, Ontario now offers operators two options:

- the proponent may submit a plan for Ministerial approval, in which case the proponent is responsible for the costs of obtaining the approval;

- the proponent may submit a "certified" plan (certified by a professional engineer or equivalent). On the Province's acknowledgement of receipt, the operator is free to proceed.

In either case the proponent is bound to follow the plan and to report progress. Heavy penalties are available to enforce compliance with the plan. It would appear that the availability of the "certified" option speeds up the process of gaining approval to proceed with the work. At additional cost, however, some proponents may prefer the comfort of knowing that the Department has reviewed and approved the plan. Environmental activists have criticized the "certified" option as an abandonment of government responsibility.

Canada is not the only mining country to require mine reclamation and financial assurance for reclamation. One of the authors recently made an international survey of reclamation and security policies for the International Council on Metals and the Environment (ICME) (C. George Miller, "Use of Financial Surety for Environmental Purposes", ICME, Ottawa, 1998). The survey analysed information on 40 case studies located in 11 countries and 16 sub-national jurisdictions. These included the Canadian provinces of Nova Scotia, Ontario, Quebec, and Saskatchewan, as well as several states in Australia and the USA, Eritrea, Fiji, Indonesia, Ireland, Japan, New Zealand, Philippines and South Africa. Virtually all imposed reclamation liability on companies and had some form of requirement for financial surety.

5.7.4 Staging and financing of reclamation

It is now recognized that the prospects for successful reclamation are greatly enhanced if the mine is designed with reclamation in mind. If effective reclamation is a front-of-mind concern at the initial design stage, the most costly aspects of reclamation, such as re-handling tailings and waste, can be avoided.

As well, operators and governments realize that progressive reclamation (i.e., reclaiming as you go) can help to avoid the build-up of unfunded liabilities at the end of the mine life. Progressive reclamation can be financed with current cash flow from operations and more closely allows the matching of revenue and cost. The revised Ontario Mining Act recognizes this fact and requires that "A proponent shall take all reasonable steps to progressively rehabilitate a site whether or not closure has commenced or a closure plan has been filed." This provision has not yet found its way

into the New Brunswick Mining Act or those of other provinces, but the New Brunswick "Principles of Reclamation" mentioned above accomplish essentially the same purpose.

Progressive reclamation works particularly effectively for strip mining of coal, because the active mining zone moves over the life of the mine. Even for open-pit and underground metal mines, however, operators have found it possible in many cases to reclaim and vegetate portions of their tailings and waste deposits during mine operation.

To this point, our discussion has concentrated on the requirements facing a new mine or advanced exploration project. However, when Canadian jurisdictions, including New Brunswick, brought reclamation and security provisions into their mining acts, they found themselves confronted by the task of applying new law to existing mines.

In some cases, imposing the full legal requirements on an existing operation could have created such a heavy financial burden that the mine would have become unprofitable. This would have caused premature closure and loss of jobs. Therefore, governments have adopted transition strategies which allowed mining companies time to present reclamation plans, begin physical work on site, and set aside a portion of revenue to accumulate the funds necessary for full reclamation. In some cases these discussions are still ongoing.

5.7.5 Reclamation security: ensuring adequate funding is available for reclamation

Legislative authority

As noted above, New Brunswick's Mining Act and Regulations specify that the Minister may require a reclamation program and the deposit of security before ground is disturbed. This is a permissive rather than a mandatory requirement. By contrast, Ontario's new act sets out many detailed requirements. New Brunswick may wish to consider including stronger and more explicit language when the Act is next revised.

Forms of security

The specified forms of security in New Brunswick are: cash, a negotiable bond signed over to the Province, an irrevocable letter of credit, or a bond of an insurance company. This list enumerates

the forms of security which the government must accept. In addition, the Act gives the Minister discretion to accept any other form of security.

The ICME survey showed that governments accept a wide range of financial instruments as security, including the following: Balance Sheet Test (5 instances); Bank Account (in Trust) (1); Bank Guarantee or Bankers' Undertaking (6); Cash Bond or Cash Deposit (3); Cash Trust Fund (3);Corporate Guarantee or Parent Company Guarantee (8); Deposit of Securities (1); Financial Reserve (3): Letter of Credit (12); Mining Reclamation Contract and Security Agreement (1); Performance Bond (5); Pledge of Assets (1); Reclamation Bond or Closure Bond (4); Surety Bond (2). It is possible that some duplication occurs in this array: essentially the same instrument may be called by different names in different countries. Where sufficient detail was provided by respondents, however, like instruments were grouped under a single designation.

The total number of surety instruments mentioned is greater than the total number of case studies, because in some cases more than one type of surety was required. For example some U.S. states require a letter of credit for a portion of the anticipated liability, but the operator is allowed to post a softer form of surety (e.g., corporate guarantee) for the remainder.

Application of various forms of security

Each of these forms of surety provides a different level of security to government. Each has its own characteristic cost to the operator in terms of the amount of capital tied up unproductively. The best reclamation policy is one that allows government and operator to negotiate the form of surety that provides the best combination of adequate security and low cost.

A few specific surety options are discussed in more detail below. Each has its uses in particular situations.

- . *Corporate guarantee.* This is the "softest" form of security (offering the least protection for the government and the least expense for the company). It may be appropriate when the operator is a large diversified profitable corporation with many sources of cash flow. Where the actual operator is a subsidiary of a larger company, a guarantee may be issued by the parent company. Some caution may be appropriate in applying this form in the mining industry. Increasing price volatility in recent decades has heightened the financial

vulnerability of even the largest Canadian mining companies. In the mid-1980s, for example, an extended down-cycle threatened several of Canada's premier mining houses with near-bankruptcy. Governments sometimes take a harder surety for part of the risk (e.g., letter of credit) and accept a corporate guarantee for the remainder.

- *Deposit of cash or negotiable bond.* This is the "hardest" and most expensive form of surety. Operators dislike it: it ties up spendable capital and is a dead weight on the corporation.
- *Letter of Credit.* In this case, also a "hard" surety, the operator does not use actual cash, but obtains a time-limited (usually 1 year) bank guarantee of the obligation. An annual fee is involved, typically less than 1% of the face value of the guarantee. While appearing inexpensive, the letter of credit nevertheless ties up capital, as it limits other financing options and represents a loss of borrowing power.
- *Balance sheet test.* The operator agrees to maintain specified financial ratios (e.g., current assets over current liabilities) above certain limits or to maintain a bond rating above a specified level. In some cases, several measures of financial strength may be worked into the formula. The ICME survey identified one such test, used by U.S. government agencies such as the EPA, which is extremely complex. Violation of the limits specified in a balance sheet test customarily triggers a shift to a harder surety, e.g., a requirement for a letter of credit. While towards the "soft" end of the spectrum, balance sheet test obligations must be disclosed to financial regulators, investors, lenders and bond rating agencies. They therefore constrain the credit-worthiness of the corporation.
- *Pledge of assets.* A corporation may offer government a lien on hard assets as surety for its reclamation obligations. The assets in question may be the mine's processing plant and equipment, truck fleet, etc. Depending on the realizable value of the assets, this may be a fairly soft form of surety. Any government which has to depend on the salvage value of a mill and head frame to finance a reclamation program may feel itself in a fairly weak position. Nevertheless, the government may have little choice in the case of an existing mine. Such a pledge may be the best security the government can obtain in the circumstances. Demanding a deposit of cash from the operator of a marginal mine may be tantamount to forcing a financial failure. The same operator will not be able to obtain a bank guarantee or letter of credit, nor will it be able to meet a balance sheet test. Its corporate guarantee will be essentially meaningless (unless there is a parent corporation which is willing to supply a guarantee). In fact, Canadian provinces have often been forced to accept a pledge of assets from existing mines as the best available surety. Allowing the company to continue to

operate while devoting a portion of cash flow to reclamation may effectively diminish the environmental liability over time, though it may not totally extinguish it. Still, partial success is better than causing the mine to shut down prematurely leaving all the liability to government.

5.7.6 What securities are provinces taking? What is available in practice?

The previous section has discussed the application of different forms of security from a rather theoretical point of view. In practice, a question that occurs to government officials involved in this policy area is, "What can I realistically ask for as security? What can I get? What are other provinces getting?"

Actual security arrangements in place are confidential to the governments and companies involved. It is not possible therefore to develop a data base of securities which have been accepted by provinces. It is known, however, that in the many cases involving an existing mine, particularly if it is only marginal, governments have been pretty well obliged to take what they could get.

There have been cases where the province was forced to take the salvage value of mine buildings and equipment as security when no better option was available. In at least one other case, the author has heard that a truck fleet was pledged as security. For reasons already discussed, the government may have no practical choice other than to allow the mine to continue to operate with a relatively small reclamation security in place.

5.7.7 Comments and suggestions received

Industry respondents noted that public attention will continue to be focussed on the need to reclaim mines properly. The industry must be responsible for its own sites, but reclamation expectations should be established in advance to avoid surprises. Desirable policies would include: taxation measures to encourage companies to set aside necessary funding; flexible reclamation securities that allow mine development to proceed but provide adequate assurance against environmental damage; relief from continuing site responsibility (exit ticket) when reclamation is complete and adequate financial provision is in place.

Government officials made us aware of the DNRE Principles of Reclamation quoted in the Introduction to this section. These seem an excellent method of notifying operators of the government's expectations. They also stressed the flexibility inherent in the New Brunswick approach, in that legislation has deliberately been designed to be permissive rather than mandatory. Since every situation is different, it was considered better to allow scope for interpretation in the application of legislation. In practice, as has been demonstrated, the Province insists on a high standard of reclamation and the provision of adequate security. However, the means by which the objectives are achieved are worked out through discussion with the operator.

5.7.8 Finding the right balance: policy implications

New Brunswick wishes to have reclamation policies which protect the environment and meet the needs of the public while providing an attractive investment climate. In general, the provisions of the current Mining Act and Regulations are in line with other Canadian jurisdictions. However, some fine tuning may be appropriate.

We have noted that the Mining Act does not explicitly require operators of exploration and mining activities to be responsible for reclamation of disturbed land, as some provinces do. We have suggested, as an observation, that the Province may wish to consider adding this provision when the Act is next reviewed. However, because of DNRE's proactive work with operators, we do not consider this sufficiently urgent to warrant a formal recommendation.

The need for certainty and clarity of expectations regarding technical reclamation standards will be met when DNRE has completed an explanatory booklet now in preparation. We would encourage the Department to include a section on the government's expectations, principles, and criteria regarding the form and amount of reclamation security. This is particularly important where the security will be deposited in respect to reclamation plans involving long-term site management.

5.8 Energy costs

5.8.1 Energy consumption in mining and processing

The mineral sector is a heavy user of energy. The Mining Association of Canada (MAC) estimates that the production of mineral products to the prime metal stage (or equivalent) in Canada consumes about 8% of the energy used by all of industry:

> *Canada's metal mining and non-ferrous smelting and refining industries represent approximately 6.3 percent of Canada's total industrial energy consumption. Of this total, metal mining, which includes gold, base metal, and iron mines, represents 3.4 percent, and non-ferrous metal smelting and refining represents 2.9 percent of Canada's total industrial energy consumption.*
>
> *With the addition of the non-metal mining sector, metal mining and non-ferrous smelting and refining accounted for about 7.9 percent of total industrial energy consumption in 1997 and about 8.1 percent of direct industrial carbon dioxide emissions* (The Mining Association of Canada, Environmental Progress Report, 1999).

Table 5.6 (next page) displays estimates of end-use energy demand for various sectors in the Canadian economy. To provide a sharper perspective on the mineral industries, the total industrial demand is broken down into its main components. The figures shown for mining and non-ferrous smelting and refining differ slightly from those offered by the MAC. Note that if iron and steel is included with mining and non-ferrous smelting, the total of the mineral industries would represent approximately 17% of total industrial demand or 7.6% of total Canadian demand.

Two forms of energy are predominantly used in the various stages of production.

- *Electricity* is typically used in underground mines for ore hoisting, lighting, ventilation, air compression and pumping; in mills for crushing and grinding, air compression and pumping; in smelters for general industrial uses; and in electrolytic refineries for the purification of metals. The last application is very energy-intensive. Hydrometallurgical plants are also electricity users.

- *Hydrocarbon fuels* (diesel, gasoline, LPG and natural gas) are used in open-pit mines for ore haulage (also in some underground operations based on ramp access); in mines and mills for heating and drying; in metallurgical operations; in the transportation of ores, concentrates and products; and, in remote locations, for the on-site generation of electricity. Construction and reclamation operations typically require motorized equipment using liquid fuels.

Table 5.6: Energy demand by sectors of the Canadian economy
(Petajoules and percentage of total)

	1990		1994		1995	
	Quantity[1]	%	Quantity[1]	%	Quantity[1]	%
Total end-use demand	7,340.2	100.0	7,763.8	100.0	7,966.6	100.0
Residential	1,429.9	19.5	1,520.1	19.6	1,511.5	19.0
Commercial	892.7	12.2	965.9	12.4	1,005.6	12.6
Industrial	3,122.2	42.5	3,294.6	42.4	3,424.7	43.0
Transportation	1,895.4	25.8	1,983.2	25.5	2,024.9	25.4
Total industrial demand	3,122.2	100.0	3,294.6	100.0	3,424.7	100.0
Pulp & paper mills	743.8	23.8	830.6	25.2	881.0	25.7
Chemical	237.5	7.6	242.5	7.4	270.5	7.9
Iron & steel	219.3	7.0	234.1	7.1	237.5	6.9
Smelting & refining	183.0	5.9	215.3	6.5	217.6	6.4
Mining	96.6	3.1	121.7	3.7	133.7	3.9
Other manufacturing	561.7	18.0	479.9	14.6	544.8	15.9
Construction	44.4	1.4	35.1	1.1	33.5	1.0
Forestry	15.7	0.5	10.9	0.3	11.1	0.3
Cement	58.2	1.9	49.0	1.5	50.8	1.5
Petroleum refining	323.8	10.4	310.3	9.4	315.3	9.2
Non-combustion	638.3	20.4	744.9	22.6	728.9	21.3

Note: 1. Quantity of energy consumed, petajoules

Source: Canada's Energy Outlook: 1996-2020, Energy Sector, Natural Resources Canada

The cost of energy used in mining and processing represents a major item in the operating cost ledger. In its 1999 Environmental Progress Report, The Mining Association of Canada (MAC) notes that energy costs account for 10% to 25% of production cost. Naturally, this is not a constant percentage of operating cost for all mines at all times. The cost varies with the fluctuating price of energy and with operating parameters. By comparison with an underground vein-type gold mine, a low-grade open-pit copper mine will spend proportionately more on energy for ore haulage and grinding, but proportionately less on wages.

The total cost of fuel and electricity used in the Canadian non-fuel mineral industries in 1996 amounted to slightly more than $975 million. Of this, the production of metals accounted for $686 million, or 70% of the total (Canadian Minerals Yearbook, 1998).

For New Brunswick, a 1992 study on Energy Efficiency Potential (commissioned by DNRE, quoted by New Brunswick Mining Association, NBMA, in a submission entitled *Staking a Claim for the Future*, October 1999) surveyed the energy consumption profile of 5 New Brunswick mines. Combining surface and underground operations, the largest component of energy use was flotation and drying (45%) followed by crushing and grinding (18%), heating and ventilation (16%) and drilling/blasting/mucking/hoisting (15%). Other uses constituted 7% of the total. The form of energy used was divided more or less equally between electricity and refined petroleum products (48% to 52%). The study identifies a temporal shift away from electricity and towards natural gas and oil.

A survey carried out more recently by NBMA showed that electricity purchases by the New Brunswick mineral industry increased by over a third between 1990 and 1997 (from slightly under $30 million to approximately $41 million).

5.8.2 Energy efficiency and energy conservation

Because of the significance of energy costs, mining companies have made considerable efforts over the years to conserve energy. Subsequent to the first oil shock in the mid-1970s, the Canadian mining industry began to participate in the Canadian Industry Program for Energy Conservation (CIPEC) and formed an Energy Conservation Task Force to encourage more rapid progress. Individual companies were members of the Task Force on a voluntary basis and nominated management representatives to participate in its work. The task force gave energy managers a forum to exchange ideas. It also developed a score-keeping system to track conservation achievements.

The federal government supported this effort (and parallel organizations in other industrial sectors) for several years with a centralized CIPEC secretariat and provided modest funding for sectoral secretariat services. The Mining Association of Canada (MAC) acted as the formal sponsor for the mining and metals sector Task Force.

As a result of these voluntary industry efforts, substantial energy efficiency improvements have been documented. While the actual quantity consumed varies with production levels, the quantity of energy consumed per unit of production has steadily declined. Over a 25-year period, the Task Force logged energy efficiency gains among member companies in the order of 0.5% per year (normalized on production levels). While this may not seem very rapid progress, such an improvement compounded over 25 years amounts to about a 12% gain. In almost all cases, small capital projects designed to improve energy efficiency were also highly economic, enjoying short pay-off periods in the order of 1-3 years.

In the mid-1990s the impetus for energy conservation heated up as the issue of global warming came to the fore. Energy conservation was seen as a valid policy response to avoid more draconian measures while fulfilling Canada's commitments under the Climate Change Convention. The government secretariat was beefed up under the name of the Voluntary Challenge and Registry. Industry was now required to support it financially.

The Association describes its new arrangements as follows:

> *In 1996, MAC established its Mining Energy Task Force to monitor energy performance and encourage continuous improvement in energy efficiency. In doing so, MAC reinforced its 25-year history with the Canadian Industry Program for Energy Conservation (CIPEC),and established a target of one percent per year improvement in energy consumption per unit of output over the period 1995-2000,stabilizing at 1990 levels by the year 2000. MAC recently extended its one percent annual improvement target in energy consumption per unit of output for the period 2000-2005.*
>
> *As of December 1999, 13 of 30 MAC members, representing the majority of Canadian metal mining and nonferrous smelting and refining energy consumption, have submitted Action Plans to the VCR. Ten of these MAC members have also submitted Tier II action plan progress reports. The MAC Energy Task Force is working hard to promote voluntary actions, communicate new information, and assist individual organizations with energy efficiency problems and planning.* (MAC, Environmental Progress Report, 1999).

Turning to New Brunswick, a submission by the New Brunswick Mining Association points out that rigorous energy efficiency efforts by mining industry operators have reduced the energy intensity of their operations by 3.8% between 1990 and 1997. Two examples of excellent performance are given. The New Brunswick division of Potash Corporation of Saskatchewan won a national Industrial Energy Innovator award from the federal government for reducing the energy required for crystallizer product by 30%. Noranda's Brunswick mine established its energy efficiency program in 1982 (one of the leaders in MAC's energy efficiency program under CIPEC). The winner of several achievement awards, the mine has realized an estimated cost saving of $10 million between 1982 and 1994.

The above brief history indicates that industry is aware of both the economic and public policy reasons to conserve energy and improve energy efficiency. The control of all production costs is vitally important to a cyclic industry such as mining. A useful role for government is to reinforce these efforts wherever possible.

5.8.3 Energy price trends

In the recent past, Canadian energy consumers, both industrial operations and individuals, have experienced rising prices for energy.

- Crude oil prices have moved sharply higher in the past year. Drivers have noted with concern that retail gasoline prices have moved up by 30% or more in that period. Upward pressure has also been felt by industrial consumers of petroleum products, but contract provisions may have moderated the rate of increase. Experts differ as to whether these new price plateaus will be sustained or exceeded by future market conditions. It is beyond our scope to analyse this question in any detail. Suffice it to say that heavy industry is concerned.
- Of equal concern within the New Brunswick mining industry is the fact that the Province's regulated electricity prices have increased strongly over several years. In its October 1999 submission, the NBMA points out that the power rate for large industrial consumers moved up by an average of about 26% between 1990 and 1997.

Future energy prices will be determined by the interplay of market forces in Canada and abroad. Certain structural changes are taking place in North American energy markets, complicating the

outlook even further. We discuss these briefly in the next few paragraphs. We merely wish to point out here that the competitive position of the Province's mineral industry will be seriously affected if its energy cost position deteriorates relative to that of producers in other jurisdictions.

5.8.4 Structural changes in energy markets

Electricity: promise of deregulation and competition

In electricity, a wave of deregulation is sweeping across North America, challenging established ways of doing business. In earlier times, economists agreed that the public interest was best served by giving power utilities a monopoly on the generation and distribution of electricity in a given jurisdiction. In many cases, these monopolies were state-owned (as is the case with NB Power). It was the common understanding that only a monopoly could afford to create and maintain the heavy infrastructure involved in generating and distributing electricity. Utilities typically financed expansions with debt and bondholders required adequate security offered by monopoly ownership. Moreover, only a monopoly could afford to maintain the spare capacity needed to guarantee power availability to handle peak loads and reliability in the case of an outage of one or more generating plants. To prevent price gouging, the prices of electricity were regulated by public utility boards.

Under a deregulated pattern, the utility is compelled to make its distribution infrastructure accessible (for a rental fee or transmission charge) to private generators, distributors and consumers of power. In effect, the wires become a common carrier, similar to a railway. Competition between generators and between distributors determines the price of electricity at any point, and price regulation is unnecessary. This general pattern is already established in Canada with the telephone system.

Deregulation is in progress in some parts of Canada, but has not become a fact in New Brunswick. A DNRE discussion paper (posted on its web site) points out that there are many transition issues to be considered before deregulation is implemented. As early as 1997, the Province announced support for the principles of deregulation and competition in electricity markets. A Task Force reported on the issues in 1998. In May 1999 the report of a select committee of the legislature suggested a two-stage approach to the transition.

Whatever the timing and process, deregulation holds out the possibility of reducing or moderating energy price pressures on industrial producers. As well, some mineral operations, such as smelters, have the possibility of generating cheap power from waste process heat. If this heat could be sold to the grid in periods of excess, the smelter would clearly become more economic.

Petroleum and petroleum products: growth of offshore and oil sands

Canada is self-sufficient in hydrocarbon energy, and the balance is improving. Historically, imports to Atlantic provinces and Quebec were more than counterbalanced by exports from the western provinces. As production from western oilfields declined, the deficit was more than made up by substantial increases in synthetic crude from oil sands.

Net exports are projected to increase and imports will decline. For one thing, oil sands production capacity is currently undergoing rapid expansion. For another, Eastern Canada is beginning to see production of both crude oil and natural gas from offshore sources.

Will increased Canadian crude production benefit New Brunswick? The benefits to New Brunswick, in terms of prices for refined petroleum products such as diesel and gasoline, will likely be marginal. Crude will undoubtedly be sold to Canadian refineries at prices close to world levels, possibly less an allowance for the shorter transportation haul. However, the fact that huge volumes of crude are transported long distances economically today indicates that any cost reduction will be minor.

The situation may be different for natural gas, in which transportation is a more significant fraction of the final cost. A trunk pipeline is being built through New Brunswick to carry Sable Island gas to markets in New England. This means that industrial quantities of gas will be available for the first time in the Province.

For consumers located close to the route of the pipeline, gas will offer a lower-cost alternative to liquid hydrocarbon fuels for many applications. However, providing gas to more distant customers (such as mineral and metal producers in Northern New Brunswick) is an economic and policy challenge. A select committee of the legislature made recommendations in November 1998 to promote policies which would ensure access to gas at economic prices, but without subsidization. The suggested principles were confirmed in the Government's Gas Distribution Policy released a

month later. The New Brunswick Mining Association has endorsed the policies enunciated there (*Staking a Claim for the Future*, NBMA, October 1999).

Climate change policies and strategies

An unknown in the energy cost equation for the future is the impact of measures governments adopt to counter greenhouse gas emissions. Environmental activists and theoretical economists have postulated that government-imposed price increases for fossil fuels would have the "desirable" effect of reducing their consumption and thereby lower CO_2 emissions. Others have proposed other draconian measures such as green taxes on fuels.

To date, the Canadian position at international discussions is that the fundamental nature of our country increases its intensity of energy use. The Canadian economy would therefore be extremely vulnerable to any such measures and our standard of living would fall dramatically in comparison to that of other countries. Nevertheless, the Government of Canada has agreed to make cuts in greenhouse gas emissions of around 30% of business-as-usual emissions.

How will this be achieved? The preferred means is through voluntary energy efficiency programs in the first instance. Other measures may be required if the voluntary results are insufficient. It is most important that all segments of Canadian society make a concerted effort to reduce energy usage per unit of output, as selected mining companies have done. If voluntary measures fail, the Canadian economy may suffer significant damage from other, more stringent measures. The mining industry, as a heavy energy user, is particularly vulnerable. It would be appropriate for the Province to encourage all companies, including mining companies, to participate in voluntary energy conservation programs.

As well, provincial governments can have an influence on the negotiating position of the federal government. It would be well advised to follow negotiations carefully and ensure that federal officials are well aware of implications for New Brunswick of alternative greenhouse gas policies.

5.8.5 Policy implications

This section has shown that energy costs have a very significant impact on the viability and competitiveness of the mining industry in New Brunswick. Therefore, the government should do

everything possible to ensure that these costs are kept to as low a level as possible. In particular, it may wish to consider the following recommendation.

Recommendation

5.6 The Government should work to ensure that industry energy costs are minimized by: encouraging energy conservation; maintaining its support of electricity deregulation and competition; ensuring that its regulatory structure in relation to natural gas transmission favours availability of gas for New Brunswick industrial users; and closely monitoring international negotiations under the Climate Change Convention to ensure that Canada does not offer unrealistic commitments.

6. Declining Access to Land Base

6.1 Introduction

In Canada's frontier society, the exploitation of natural resources was the dominant economic activity. Gradually, agriculture displaced fur, forestry and minerals as the primary employer of Canadians. In the second half of the century just past, Canada industrialized and the population became overwhelmingly urban. A more prosperous population with significant leisure time turned to outdoor recreation as a way to escape the city. Environmentalism became a fundamental value of Canadians. To many, the natural landscape is now something to value and preserve rather than to exploit.

Through the early part of this transition, the mineral industries could co-exist with other economic activities. Rules for resolving conflicts with farmers and other landowners were developed and worked reasonably well. There was enough land for everyone.

More recently, the mineral industry has been progressively constrained in the amount of land to which it has access for exploration. Urban sprawl, transportation corridors and other single uses took their toll. But the biggest and most dramatic changes came only in the past decade.

The largest land consumer in recent years has been the creation of ecological preserves and other areas protected for their environmental value. In most of these areas no economic activity is permitted. In the early 1990s, federal and provincial ministers responsible for environment and parks endorsed a Canada-wide "Protected Areas Strategy." They agreed in principle to set aside a substantial portion of Canada's land area for this purpose. Environmental groups and some governments insisted on an average withdrawal of 12%. The agreement was ratified by all governments.

New Brunswick's approach to the Protected Areas Strategy has been more moderate than some other provinces. While British Columbia immediately undertook to protect the full 12%, the New Brunswick government, appreciating its limited scope for further land withdrawals, offered a target in the order of 5% to 6%.

The mineral exploration industry has had tremendous difficulty with both the principle and the application of a no-mining policy over such a large aggregate area. Industry has been dissatisfied with the processes used to select land for protection. Some jurisdictions have made efforts to keep high-mineral-potential areas out of the protected zone, but industry is concerned that many prospective areas are included. There is little doubt that Canada's future potential for mineral production has been affected.

Producers have been equally concerned, but they have more options than prospectors and can afford to be more philosophical: "If we can't mine in Canada, we can always go to Chile." As well, a number of junior mining corporations have found it possible to raise money in Canada for overseas exploration. These adaptations are realistic, but they give home-grown prospectors little comfort.

6.2 Present status in New Brunswick

6.2.1 Restrictions on land available for exploration and mining

At 71,083 km^2, the Province's total area is small as compared with other important mineral-producing provinces. As well, it has a long history of settlement and much of the land (some 39,000 km^2 or 55%) is privately owned. Staking is allowed on private land without the owner's permission, but permission is required before work of a damaging nature is undertaken.

The Crown land remaining represents only 32,083 km^2. As a result of these factors, and even without considering the effect of new protected areas proposals, New Brunswick's mineral exploration community is highly constrained in its opportunities.

Table 6.1 summarizes current land use restrictions. It is notable that the largest single category of restricted land is for watershed protection. From recent debates in the legislature, it seems that the Government is contemplating an increase in the required setbacks from streams used for water supply. This could make an appreciable difference to exploration and mining activity. The largest single package of land where mineral activities are prohibited is the federally-controlled CFB Gagetown.

Table 6.1: Areas not available for claim staking, or subject to restrictions

Category	Area, km²	% of NB Land Area
Class A: Areas not available for claim staking		
A1: Protected areas - Mineral activities prohibited		
National Parks	400	0.56
Provincial Parks	215	0.30
Ecological Reserves (existing and proposed)	145	0.20
Subtotal	760	1.07
A2: Other areas closed to mineral activity		
CFB Gagetown	1,110	1.56
Other federal military lands, airports and agricultural station	225	0.32
Acadia Forest Experimental Station	90	0.13
Mining Act Reserves	165	0.22
Subtotal	1,590	2.24
Total of Class A	**2,350**	**3.31**
Class B: Areas available for staking subject to restrictions		
Watersheds	2,475	3.48
Agricultural land	1,500	2.11
Indian reserves	240	0.34
Total of Class B	**4,215**	**5.93**
TOTAL of classes A and B	**6,565**	**9.23**

Source: New Brunswick mining Recorder

6.2.2 Proposal for a protected areas strategy

In March 1997, Dr. Louis LaPierre, of the Université de Moncton was asked by DNRE to develop a Protected Areas Strategy for New Brunswick. His report, presented at public meetings the following year, was prepared with the input of a working group which included two scientific members.

Dr. LaPierre recommended that the Province select one large protected area to represent each of "the seven natural 'ecoregions' represented in New Brunswick." His report "suggests 12 possible large candidate sites" (see accompanying map, page 6-8) totaling 319,228 ha (3,192 km²) or 4.49% of the province's land area (additional to those protected areas listed in the preceding table). Land uses permitted within each protected area would vary depending on the fragility or rarity of the species present. "The main goal is to protect a site's natural value" and "uses are allowed if they do not affect that value."

Government is currently incorporating public responses and advice in finalizing the Strategy.

6.3 Comparison with other jurisdictions

It is difficult, even within a single jurisdiction such as New Brunswick, to determine categorically the fraction of land upon which mining industry activities are permitted. As indicated by Table 6.1, a large category is "lands where industry access is restricted or conditional." In some of these areas, the conditions which would have to be met effectively rule out exploration or mining. In others, exploration and/or mining may be permitted under reasonable conditions. As well, some classes of areas not mentioned anywhere in the table would clearly not permit mining (e.g., road allowances).

It is even more difficult to compare access provisions across jurisdictions. Common terms (e.g. "provincial park") mean different things in different jurisdictions. Very often terms used for a protected area in one jurisdiction have no exact counterpart in another (e.g. "ecological reserve").

An effort to standardize definitions and make valid comparisons of land access for mining among Canadian provinces and territories was made in 1991. At that time a cooperative study was carried out by the mining industry (under the banner of the Mining Industry Land Use Committee: MILUC), the Department of Energy, Mines and Resources, and the mines departments of all provinces and territories, culminating with a report to the 48th Mines Ministers' Conference.

For the purposes of the 1991 study, major classes of land use similar (but not identical) to those used in Table 6.1were defined. Each jurisdiction was then asked to identify the amount of land that fell into each of these categories and into logical subcategories within them. This method permitted zones of roughly equivalent land use rules to be classified similarly and compared across jurisdictions.

It is nearly a decade since this work was released, and no such comparisons have been made since that time. Unfortunately, too, government cutbacks have prevented changes in actual land access from being tracked over time. Because the creation of new protected areas has not stood still, these comparisons are not totally valid today. We suggest that governments may wish to ensure that such comparisons are updated at least every ten years.

International comparisons of land access restrictions could also be instructive. Unfortunately, they are difficult to obtain and, for reasons cited, difficult to make meaningful. We sought data on land access restrictions from various countries (United States, Australia, Brazil, Chile, South Africa, etc.) by working through the national mining associations. Unfortunately, meaningful responses were not forthcoming except in the case of Sweden. The following information, kindly provided by the Swedish Mining Association, neatly illustrates the ambiguity inherent in this subject.

Table 6.2 Areas closed to mineral activity in Sweden
(Areas are best estimates)

Designation	Area Km^2	Percent of Sweden
Mineral activity prohibited		
National parks	6,423	1.4
Other areas essentially closed to mineral activity *Some of these could in certain cases be conditionally available on extremely rare occasions: the protection is close to 100%.*		
Towns	4,500	1.0
Roads, railways, etc	3,200	0.7
Nature reservations	31,873	7.1
Industrial plants	750	0.2
Churches, churchyards, hospitals, hotels, schools, etc.	800	0.2
Areas of fortification (1)	?	?.?
Certain parts of the Mountain Region not included in other protected areas (2)	?	?.?
Total *(minimum, estimated by the authors)*	50,000	10.2

Source: Sven Arvidsson, Swedish Mining Association, personal communication

Notes:
1. "We are not told the areas of fortification, only that we are asked to leave if we try to enter one."
2. The Mountain Region contains about 7%-8% of the entire country. It incorporates all the National Parks and several nature reservations. Its status is seemingly ambiguous: it is not forbidden for exploration but it is for exploitation, except by permission of Parliament. Therefore for all practical and political purposes it is a closed area.

6.4 Perceived impact of a protected areas strategy

The exploration and mining communities are seriously concerned about the economic impact of the proposed New Brunswick Protected Areas Strategy and initiatives such as the expansion of watershed protection measures. If implemented, the Strategy alone could more than double the amount of land where exploration and mining are prohibited (from the present 3.3% to 7.8%).

Industry concerns are evidenced by the comments and suggestions displayed in Appendix D and summarized here. Mining does not leave a large footprint, but the search for minerals requires access to wide expanses. Industry prefers multiple land use wherever possible and believes that modern environmental standards would permit it in all but the most sensitive areas. Even if an attempt is made to avoid mineral claims and prospective areas, today's geoscience knowledge is not perfect and no areas can be ruled out. Permanent exclusion means that there will be no way of knowing whether opportunities are being lost. Formally protected areas are supplemented by other designations having the same effect, such as 'buffer zones' and 'corridors'. Other initiatives such as Aboriginal land claims also create uncertainty. Some feel that a flexible, integrated approach to land (and water) use management is required. This is more critical to the investment climate than all the exploration incentive programs combined. Some feel that other conservation measures were not considered in the development of the Strategy: it is likely the objectives could have been met by other initiatives. The cumulative impact of all land and water use management initiatives must be considered. Aside from the Strategy, proposals have been made for a "Water Classification System", a "Watershed Protection Program" and the designation of "Heritage Watersheds".

6.5 Land tenure considerations

The imposition of restrictions or a ban on mining in any given area can conflict with mineral rights held by prospectors or mining companies. Should this occur in the implementation of a protected areas strategy or other initiative such as a watershed protection measure, the Province will wish to ensure that holders of mineral rights receive adequate compensation. Legal precedents are well established for the valuation of mineral claims. The amount of compensation depends on the perceived and demonstrated potential of the claim to be a profitable producer.

6.6 Policy implications

It is not easy for governments to meet the legitimate expectations of industry while removing the possibility of developing potentially valuable resources. At the same time, there is a widespread understanding that the protection of environmental processes (including biodiversity and ecological

integrity) is fundamental to the continuation of healthy life (including human life) on earth. Thus, certain compromises are inevitable and tradeoffs must be made.

The Whitehorse Mining Initiative recognized these dilemmas. While supporting the establishment of needed protected areas, it insisted that every effort should be made to safeguard access to recognized mineral potential, that the areas protected be no larger than necessary to achieve their purpose, and that multiple use principles be accommodated wherever possible and consistent with the conservation objective.

The Province can best accommodate these principles by ensuring that all processes leading to the creation of areas which are off-limits to mining are fair and open, and that exploration and mining interests are heard and given full weight in the decision.

Recommendation

6.1 Preserve access for exploration and mining to the extent possible by: ensuring that mineral exploration and mining interests are given full weight in all decisions that affect land access; avoiding setting aside areas containing recognized mineral potential; where areas are to be set aside, ensuring that a reasonable period is given, and significant efforts made, to assess mineral potential; wherever consistent with valid conservation objectives, preserve the possibility of economic benefits by favouring multiple land use policies.

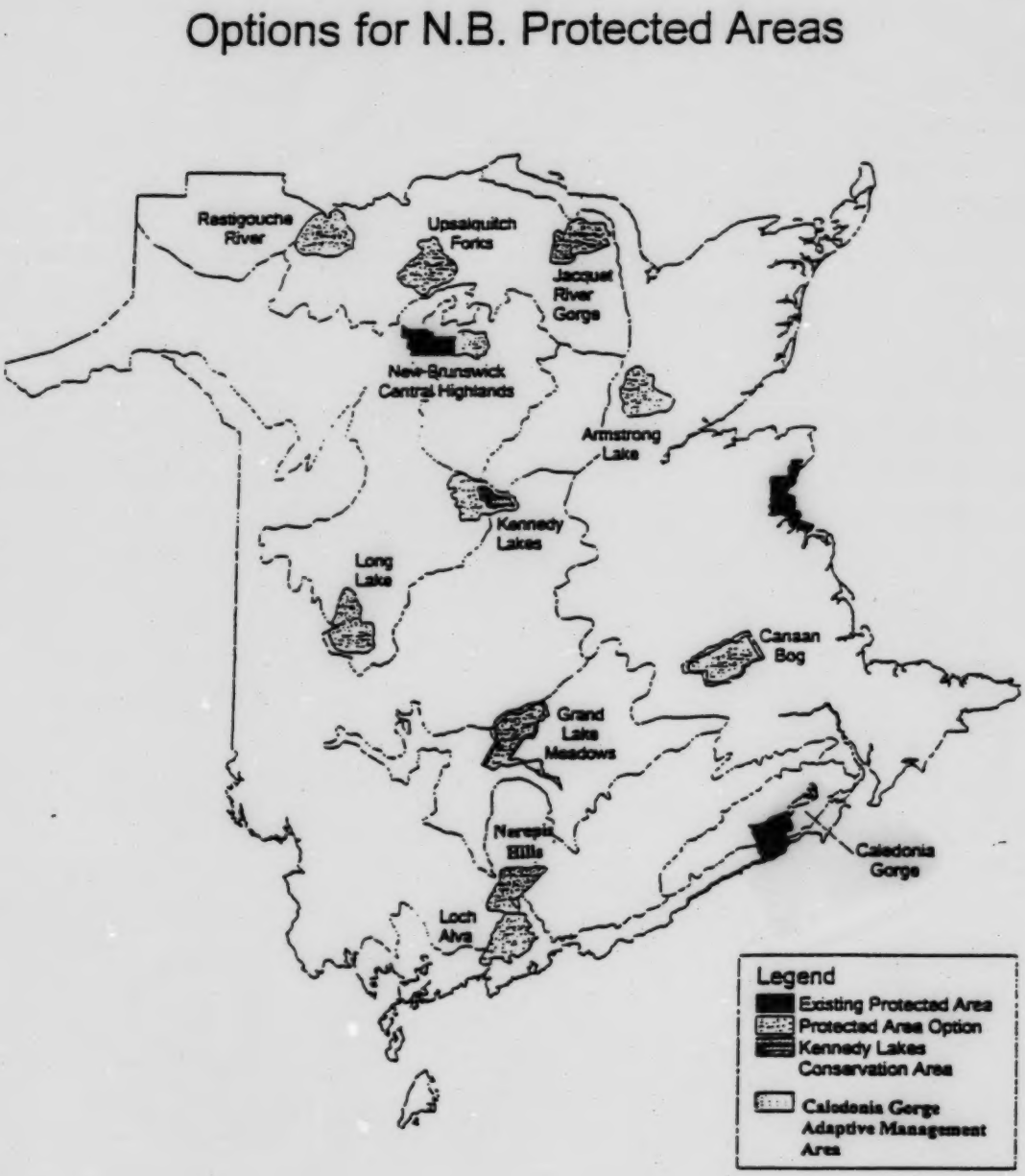


Figure 6.1: Options for New Brunswick protected areas

Source: A protected Areas Strategy for New Brunswick: A science-based approach (Summary document)

7. Other Considerations

7.1 Introduction

Four major issue areas posed by the Department of Natural Resources and Energy have been discussed in the preceding four chapters. In addition, the Government has asked for comments on other issues that affect the performance of the mineral industries and that may affect investment decisions. The purpose of this chapter is to discuss these miscellaneous issues and advise the Government what, if anything, it can do to deal most effectively with them.

7.2 Public perception of mining

7.2.1 Introduction

> *The perception is that the mineral industry (including metallic minerals, industrial minerals and hydrocarbons) is a "low-tech, sunset industry" and an environmental hazard. What should the Province do to overcome this perception? Can it continue to promote its mineral industry and eco-tourism at the same time?*

This passage from the Terms of Reference suggest that most Canadians and New Brunswickers have a generally negative attitude towards the mining industry. The Province requested suggestions as to what it could do to counter such a perception, and it raised the question whether its continued promotion of mining would be compatible with its continued promotion of eco-tourism. We will attempt to answer these questions on the basis of considerable public opinion research on mining. In the process, we will test the assumptions behind the issue as stated.

Our views are based on an exhaustive analysis of 7 opinion surveys sponsored by industry and government bodies and carried out by professional polling consultants over the past ten years. Five surveys dealt with the broad Canadian public, whereas two covered opinion leaders (government officials, business leaders, journalists, interest groups, and other media influencers).

7.2.2 Surveys of public opinion

The polls analysed here have been sponsored in the past ten years by industry and government. These surveys have been kindly made available to us by The Mining Association of Canada the New Brunswick Mining Association, and Natural Resources Canada. In chronological order, the surveys are as follows (see Table 7.1 for details):

1. "Canadians' Perceptions and Attitudes Towards the Mining Industry and Related Policy Issues", prepared for The Mining Association of Canada by Angus Reid Associates Inc., June 1989. This survey sampled the Canadian public generally but, unlike other surveys, it added a special sample of 200 individuals living in mining communities.

2. "1993 National Public Opinion Survey on Natural Resources", prepared for Energy, Mines and Resources Canada by Corporate Research Associates Inc., 1993. This survey, as well as surveys mentioned under items 4 and 7, covered forestry and energy sources (including oil and gas) in addition to minerals.

3. "Public Opinion on Key Mining Industry Communications Messages", prepared for The Mining Association of Canada by Decima Research, August 1993.

4. "New Brunswick Mineral Policy Public Opinion Survey, 1994", prepared for the Canada-New Brunswick Agreement on Mineral Development Opportunities Program by Corporate Research Associates Inc., May 1994

5. "A Survey among Opinion Leaders on Mining Industry Issues", prepared for The Mining Association of Canada by Compas Inc., March 1995. This report compared its findings with those of a corresponding 1989 Compas survey.

6. "A Qualitative Research Report on the Keep Mining in Canada Campaign", prepared for the Mining Association of Canada by Decima Research, February 1996

7. "Tracking Survey of Canadian Attitudes Towards Natural Resources Issues, 1997", prepared for Natural Resources Canada by Corporate Research Associates Inc., 1997

Table 7.1: Design parameters of various opinion surveys

Survey	Scope	Sample Size	Analyses	Comment
1. Angus Reid, 1989	National + booster sample in mining communities	1503 national + 203 booster	Univariate + Multivariate	Multivariate analysis allows segmentation of public into defined attitudinal groups.
2. Corporate Research Associates Inc., 1993	National	1504	Univariate	Designed to form a baseline study for tracking public opinion regarding natural resource industries. Covered forestry, mining and energy industries.
3. Decima Research, August 1993	National	1200	Univariate	Baseline study to determine attitudes of Canadians and their receptivity to potential messages.
4. Corporate Research Associates Inc., May 1994	New Brunswick	603	Univariate	Questionnaire largely similar to that of item 2 and results are compared with national results.
5. Compas Inc., March 1995	Opinion leaders (government officials, journalists, academics, labour, environmentalists, Aboriginal leaders)	198	Univariate	Questionnaire is largely similar to that of a survey carried out in 1989 (original not available). Sample is broader, but results are compared with the earlier survey.
6. Decima Research, February 1996	Selected federal MPs and their staff	17	Univariate	Qualitative results only; sample emphasized influential members (parliamentary secretaries, committee vice-chair and NR critics).
7. Corporate Research Associates Inc., 1997	National	1507	Univariate	Questionnaire largely duplicates that of item 2.

There were a number of differences in the design of these surveys regarding the target publics covered, the number of individuals polled, the geographical scope of the survey, the nature of the questions asked, etc. These differences are highlighted in Table 7.1. As well, the methodology of analysis varied to some extent among the consultants' reports.

The surveys also exhibited certain important similarities. A number of common themes (e.g., environmental issues) were dealt with by all surveys. Other issues were discussed in two or more surveys. In some cases (items 2, 4, and 7 and item 5) direct longitudinal or geographic comparisons are possible because surveys were directly modelled on each other.

As a result of these similarities, therefore, and despite the differences, we can offer some fairly robust generalizations about the public perception of mining in Canada and the way it has evolved over time. We give below some summary findings regarding the opinion of Canadians on a number of issues connected with mining. For a full description and quantitative results, see Appendix B.

It is not practical here to summarize the findings of all the surveys on all issues. We will limit our discussion to those issues which have been suggested or implied by the passage quoted above from the Terms of Reference:

7.2.3 Survey findings

Top-of-mind impressions of the mining industry

The top-of-mind evidence suggests that Canadians and New Brunswickers do not think often about mining. When prompted to do so, most have a relatively balanced view of the mineral sector. They appreciate the economic contribution of the industry, and substantially more report a favourable impression than an unfavourable one. However, they are not blind to perceived shortcomings in the areas of environment and worker safety.

Segmentation of the Canadi n public into like-thinking groups

Three distinctly identifiable, and relatively stable, currents of opinion about the mineral industry exist within Canadian society: the pro-industry group (35% of Canadians in 1989), the anti-industry or "antagonist" group (20%) and the non-committed group (45%). Neither the pro-industry nor the anti-industry group is a fruitful target for public relations work. Any information that is designed to

influence public opinion should focus on the non-committed group, taking account of its characteristics, interests and concerns. A swing of a few percentage points on any issue is likely to represent a shift of opinions **within** the non-committed group rather than in the population as a whole.

Opinion leaders: a special segment of the public

Opinion leaders' impressions of the mining industry are extremely important, as they are well placed to influence the course of future government policy. In principle, these leaders ought to be better informed than the general public about important industrial sectors. Whether they are better informed or not, they may well have opinions and attitudes that could have a major impact on the future of the industry in Canada. It is for this reason that a knowledge of their opinions is needed.

Regional differences

In company with Canadians in BC and the Prairies, those living in the Atlantic provinces tend to be relatively easy-going with respect to their opinions about mining. The most negative are residents of Quebec. Atlantic Canadians discriminate among issues in their approval of the mining industry, and they recognize the economic contribution of the industry. On limited evidence, New Brunswickers appear to share this characteristic Atlantic mindset.

Economic contribution of mining, present and future

Canadians are generally cognizant of the economic contribution of mining, though it is somewhat undervalued in comparison to other resource industries, notably forestry. The resource industries' contribution, including that of mining, to the provincial economy is well appreciated in resource-dependent regions, and even more keenly in rural communities.

Opinions are mixed regarding the future growth prospects for mining. These are consistently rated lower than for other resource sectors such as agriculture and oil and gas, but above fisheries. Even so, around half of the Canadians polled in 1997 projected better prospects for mining. While lower than for other sectors, this result represents a substantial improvement since 1993. Opinion leaders are not so sanguine: only around 25% project better times for mining, as compared with 43% for oil and gas.

Credibility of the mining industry in Canada

Available surveys differ in the believability rankings given by Canadians to various interest groups when discussing mining issues. Those who appear to be independent (universities, environmental groups, mining professionals) have fair to good credibility. Mining industry executives and government officials (particularly federal) rate fairly low. These factors must be taken into account in assigning spokespersons to carry messages to the public.

Environmental performance

Canadians have a deep-seated concern about the environmental impact of the mining industry. It is the most frequently-cited weakness of mining. Canadians are equally divided on whether or not the environmental impact of mining is acceptable, given the industry's economic contribution. Slightly over half of Canadians believe that the industry is committed to environmental improvement, though opinion leaders single out mining as the industry with the highest degree of commitment, slightly above forestry. Canadians do not believe that improved environmental protection will harm competitiveness or cost jobs: in fact the majority believe the reverse. Environmental concerns extend to land use. Half of Canadians would expect mining activity to cause major disruption to wildlife and fish habitat, and a majority would advocate abandoning a mining project that did interfere with wildlife.

Technology, production methods, and worker safety

Contrary to expectations, mining is consistently rated as a leader in the development and use of new technology by a majority of Canadians, including opinion leaders. Similarly, while Canadians are concerned about mining workers' health and safety, the industry is given credit for working to protect them. By a small margin, more Canadians find the industry's safety record "good or very good" than "poor or very poor", though mining is rated behind other industries such as manufacturing and construction. A majority of Canadians accept that protecting workers is an industry priority, and opinion leaders single out mining as the industry that has made the most strides in emphasizing employee training and safety.

7.2.4 Policy implications

The study's Terms of Reference pose two questions. We will offer comments and recommendations on both:

1. What should the Province do to overcome this [negative] perception?
2. Can [the Province] continue to promote its mineral industry and eco-tourism at the same time?

Action to overcome negative perception

There appear to be three broad options open to the Province to deal with public perception. First, the Government could mount a significant campaign to persuade New Brunswickers not to consider the mining industry "a low-tech, sunset industry and an environmental hazard." Secondly, the Government could have a low-key program, in cooperation with industry, to provide factual information on those aspects of the mining industry's performance which are of concern to residents of the Province and visitors. Third, the Government could do nothing.

We suggest that the government consider the second option. We have several reasons for this position:

- There is no evidence that Canadians have a blanket negative perception of the mining industry, as initially suggested by the Terms of Reference, to justify a massive program.
- More Canadians are consistently pro-mining (35%) than anti-mining (20%).
- The largest group of Canadians (around 45%) are not committed to either a positive or negative attitude towards mining. Their opinions depend on the issues being discussed, and they are open to new information.
- If forced to choose between a favourable and an unfavourable verdict, Canadians are 2-3 times more likely to give a favourable opinion of the mining industry.
- Atlantic Canadians, including New Brunswickers, are generally more favourably disposed than other Canadians to mining.
- Nevertheless, significant numbers of Canadians and residents of New Brunswick have concerns about mining in the areas of environment and (to a smaller extent) worker safety, suggesting that the province should not be completely passive.
- Industry has the most to gain from an improved image based on factual information, and would likely be interested in cooperating with government in a public information program.

In any information program the Province should not attempt to whitewash the industry. Rather, it should document the steps that are being taken by industry and the Government to reduce the

industry's environmental impact and improve worker safety. Factual information about the relative safety record of mining as compared with other industries would help to counter misperceptions that place mining lower than its actual record would suggest.

Messengers for this program should be carefully chosen for their credibility, based on some of the evidence cited above. Ministerial declarations may carry less weight than statements by professionals such as geologists and engineers, whether employed by industry or government. Consider that Environment Canada's ubiquitous television spokesman, David Phillips, is identified as a government "scientist."

Promotion of mining and eco-tourism

The second question is, "Can [the Province] continue to promote its mineral industry and eco-tourism at the same time?" Our answer is a strong "yes." Most Canadians value the economic contribution of mining and other resource industries. At the same time, there is a strong identification with the environment and with nature. Eco-tourists are drawn from all segments of society. As such, they are a probably a fair sample of all Canadians. If so, the majority fall into the groups which are either positively disposed to mining or non-committed. Canadians strongly believe that a clean environment is consistent with a strong economy and would welcome evidence that this is the case. They are receptive to the notion that the mining industry is committed to reducing its environmental impacts.

Rather than backing off the promotion of either mining or eco-tourism, the Government should consider making positive evidence available to eco-tourists that the NB resource industries are making strides in protecting the environment. Among other methods, this could take the form of designating model sites and promoting visits to them by eco-tourists. There, visitors could see the latest, best and cleanest technology at work, e.g., tailings reclamation. This could well boost the Province's reputation, and the industry's, as a steward of the environment. Such "show-casing" programs are well developed in the United States, where resource industries cooperate with government agencies (e.g., U.S. Forest Service) to demonstrate good industry practice.

Recommendations

7.1 The government should consider a low-key program of factual information concerning especially the industry's economic contribution, its improving environmental record and its

safety record. The information program should be carried out in cooperation with organizations representing the New Brunswick exploration and mining industries. The proposed information program should document the steps that are being taken by industry and the Government to reduce the industry's environmental impact and improve worker safety in New Brunswick. Messengers for a communications program should be selected from professionals such as geologists and engineers, whether employed by industry or government.

7.2 We unequivocally recommend that the Province continue to promote both its mineral industry and eco-tourism. The Government could consider making positive evidence available to eco-tourists that the New Brunswick resource industries are making strides in protecting the environment. Among other methods, this could take the form of designating model sites and promoting visits to them by eco-tourists, who could see first-hand the latest and best technology at work.

7.3 Government resources directed to the mineral sector

7.3.1 Introduction

Given the importance of the mineral industry to the provincial economy (and tax revenue), is the government devoting enough resources towards servicing and sustaining this sector?

This quotation from the Study Terms of Reference questions whether government policies and programs are sufficiently well funded to be of adequate help to the mineral industries. The question does not arise from any altruistic impulse. On the contrary, the government wishes to know whether a different mix or emphasis in its programs would yield better results in terms of investment and jobs for the benefit of New Brunswickers.

A quantitative answer to this question is beyond our scope in this report. Rather, we will rely on a limited number of available quantitative indicators, supplemented by the comments of respondents as to the perceived adequacy of government support, both quantitative and qualitative.

7.3.2 Economic contribution of the mineral industries

The following 1998 statistics give some idea of the industry's economic contribution to the province:

- Average1998 weekly earnings in the New Brunswick mining industry were $861, representing one of the highest earning levels of any industry in the province (New Brunswick's average weekly earnings in November 1999 were $523.04).
- Mining and minerals contributed $852 million (value of production) to the NB economy in 1998, or $1,131 per capita.
- This sector employs over 3,200 people directly in mining and quarrying (approximately 1% of the provincial workforce).
- Combining data on weekly earnings and employment, we deduce that the total mineral industry payroll in New Brunswick is approximately $142 million annually.
- At an average 30% effective income tax rate, individual taxes paid by employees of mining would amount to nearly $43 million.
- Direct revenue received by government in the form of income and mining tax has been approximately $12 million in recent years. Since this source of government revenue is highly cyclical, varying with mineral prices, it can be expected to increase when metal markets recover from recent depressed levels.

7.3.3 What is government putting back?

The annual budget of the mineral side of DNRE is about $4.4 million. It is appropriate to ask whether the government can realistically expect to invest only one-third of annual direct mineral revenue to support this industry.

How does this level of support relate to that offered to other natural resource industries? The New Brunswick government currently invests $40 million annually in silviculture programs. The forestry industry generates approximately $49 million in stumpage fees. To match the forestry ratio, the government would need to invest around $9.7 million to support the minerals industry.

Another useful benchmark of adequacy is to look at New Brunswick spending in relation to that of other provinces. Table 7.2 compares the geoscience budgets of various jurisdictions. Data are not available to compare the total budgets of mines units in the provinces, but it will be noted that

for New Brunswick the geoscience component is about 75% of the total DNRE mineral management budget. This ratio is fairly typical of other jurisdictions. Therefore, the following data will give a meaningful indication of the variation in the allocation of total resources.

Table 7.2: Geoscience resources compared across jurisdictions

Jurisdiction	Geoscience Personnel (FTEs)	Geoscience Expenditures ($ thousand)	Value of Mineral Production ($ thousand)	Expenditures as Proportion of Value of Production (Percent)
Newfoundland	49	4,837	934,095	0.52
Nova Scotia	41	2,466	597,472	0.41
Prince Edward Island	0	0	3,395	0.00
New Brunswick	33	3,270	924,758	0.35
Quebec	130	17,556	3,319,996	0.53
Ontario	124.5	13,457	5,643,612	0.24
Manitoba	45.5	3,736	1,023,909	0.36
Saskatchewan	49.3	2,452	5,215,467	0.05
Alberta	76	2,532	26,039,407	0.01
British Columbia	43.5	6,459	4,248,218	0.15
Northwest Territories	17	2,371	798,403	0.30
Yukon	17	3,036	423,069	0.72
Canadian Total	626	62,170	49,171,801	
Canadian Average	52	5,181	4,097,650	0.13
Canadian Median	44.5	3,153	979,000	0.33

Source: *Provincial Geologists' Journal*, Committee of Provincial Geologists, 1997

In comparison with other mineral-rich Atlantic provinces (Nova Scotia and Newfoundland), New Brunswick's spending on minerals is definitely on the low side. It devotes the least manpower (absolute level) and the least financial resources (as a proportion of mineral production).

In addition to the comparisons presented here, we wish to draw the reader's attention to Sections 5.3 (Exploration incentives), 5.4 (Processing technology incentives), and 5.5 (Tax incentives), as well as to the data displayed in Tables 5.2 and 5.3. Throughout, it has been noted that New Brunswick's programs fall behind those of many competing jurisdictions.

7.3.4 Comments and suggestions received

Respondents to our survey made relatively few comments directly on the general subject of government resources devoted to the sector. Perhaps the question was not raised sufficiently clearly in our questionnaire. However, the need for more adequate support efforts devoted to the industry was a frequent theme (support was sometimes referred to as "promotion").

Industry respondents noted that gathering and publishing geoscience information is a large part of the mineral resources work, and it helps the industry. While the "marketing" effort is also credible and praiseworthy, its budget does not compare to investments made promoting other sectors, such as tourism. DNRE is not adequately organized or staffed to promote the mineral industry. The mineral industry is far behind forestry, natural gas, native issues, NB Power, etc., in terms of government attention. Budget stringency over the years has led to skill gaps in DNRE, and the situation appears to be getting worse. More financial assistance from the government is certainly justified.

In addition to any comments on the overall budget limitations, many respondents offered suggestions for expanding and improving DNRE programs directed to the sector. These would all cost money. These requests need to be interpreted as another indication that current support and resource levels are inadequate.

7.3.5 Policy implications

The budgetary limitations of the Government of New Brunswick are well understood. The Premier and Cabinet are committed to reducing and eliminating the deficit. No one can quarrel with that resolve.

We believe strongly, however, that DNRE's efforts in support of the mineral sector have been seriously underfunded for a number of years. Our survey has uncovered no evidence of inefficiency or waste. While there have been suggestions for improvement in the delivery of programs and services, no respondent has criticised the basic orientation or capability of the organization.

We therefore feel that the government should give serious consideration to preserving and/or enhancing the capability of the Department to serve the mineral sector.

Recommendation

7.3 The Government should preserve, and enhance to the extent possible, the financial resources devoted to mining and minerals within DNRE.

7.4 Minerals & Energy Division in the service of other clients

7.4.1 The issue

Traditionally, the "mines department" of any provincial government was created to facilitate and regulate the extraction of the province's mineral resources for the benefit of the people and the economy. In the early days, population pressures were minimal. Subsistence farming and fishing were the mainstays of the population. Any opportunity for higher-value economic activity (such as mining) was highly prized and sought after. Land use conflicts were virtually unknown. There was plenty of land for all. Legislation creating a mines department viewed the mission relatively narrowly.

With population growth and the development of an industrialized and diversified economy, the roles of natural resources departments have grown more complex. Scientific understanding of the earth and its processes has grown and has been called on to offer new insights into varied problems (e.g., the design of highways subject to loading by heavy vehicles, the safe design of larger structures, the characterization of soils, the choice of locations for infrastructure and for protected areas). Geoscience has increasingly been called on to satisfy a wider array of public needs. Yet, the official mandate of the "mines department" has not kept pace. It has not been expanded to coincide with the boundary of new tasks actually undertaken by the department.

The Study's terms of Reference pose the dilemma as follows:

> *Other client groups besides the mineral industry use the Minerals and Energy Division's (MED) geoscience database and make requests to MED for work/data in areas with little or no mineral potential. However, the MED currently has neither the mandate nor*

the resources to fulfill these requests, even though the information we provide is essential for proper land use planning. Would it be in the Province's best interest financially to expand the role (mandate and resources) of the MED so that it can serve all client groups?

The issue of how to handle service requests from other client groups inside government and in the private sector is not unique to New Brunswick. Indeed it was very much part of an organizational study carried out by one of the authors for a neighbouring province, Nova Scotia. The approach taken in that study may find useful application here.

7.4.2 Functions of a mineral and energy organization

In the Nova Scotia study, the functions of the corresponding organization (Minerals and Energy Branch of the Department of Natural Resources) were identified as follows:

The Branch's major duties and responsibilities are to:

1. *understand in detail the nature and processes of Nova Scotia's land base, both surface and subsurface, and inventory the Province's mineral and energy resources;*
2. *manage the development and production of mineral resources in the public interest;*
3. *encourage economic and regional development based on the responsible production and use of mineral resources;*
4. *manage programs for, and advise the government on, the optimum use of energy resources;*
5. *advise the government on any issue affecting the development and use of the minerals and energy resources, and the performance of the mineral and energy industries;*
6. *contribute geoscience knowledge, as well as mineral and energy sectoral expertise, to all Nova Scotia departments and government agencies in support of government objectives; and*
7. *serve the broad business community and the public by providing statistics, geoscience data and other information.*

> *These duties and responsibilities fall into three broad classes. First, many of the Branch's duties and responsibilities are defined by* ***legislation*** *administered by the Department (items 1, 2, 3 and 4 above). Secondly, the Branch has a duty to assist the government to* ***make informed decisions*** *on matters affecting the mineral and energy sectors, including matters primarily falling under legislation administered by other departments of government (item 5). Assisting government decision making in this way is commonly referred to as "policy" work. Finally, the Branch has a general obligation to use its expertise to provide* ***service to government departments and the broader community*** *(items 6 and 7).* (C.G. Miller, *Minerals and Energy Branch, Department of Natural Resources, Province of Nova Scotia: An Organizational Review*, April 1998).

The dilemma faced by the New Brunswick Minerals and Energy Division is identical to that which was faced by the corresponding unit (the Minerals and Energy Branch) in Nova Scotia. It seems inescapable to us that the Division is clearly required by *de facto* government policy and by the public good to offer the services identified above as items 6 and 7. In the words quoted above, **"the Branch has a general obligation to use its expertise to provide service to government departments and the broader community"**.

7.4.3 Policy implications

It is unthinkable that DNRE should withhold geoscience data or expertise from another department of government when that service would assist the client department to fulfil its own function to the public benefit. It is equally unthinkable that an official of the Division would answer a telephone enquiry from a road engineer requesting geotechnical data by saying, "We have the data you need, but I am too busy with legitimate work to send it to you." In either case, such a response would have severe political implications, and no responsible official would do this. Yet responding to these requests may well interfere with essential work which is well within the legislated mandate of DNRE.

We have no hesitation in concluding that the legislative mandate of DNRE should be revised to reflect these realities and that the Division should be resourced accordingly.

Recommendation

7.4 The government should review the legislative mandate and budget of the Minerals and Energy Division with a view to ensuring that necessary services and expertise can be rendered to other branches of government, outside agencies and the public without interfering

with the primary mandate, that of managing the mineral and energy resources of the Province.

7.5 Factors affecting mineral exploration: commodity price

7.5.1 Introduction

Mineral exploration is driven by a number of factors including, but not limited to, commodity prices, perceived mineral potential, government stability, land access, land tenure, regulatory regime and tax laws. What are the main contributing factors to the current decline in mineral exploration in the Province? Of the factors that the Province controls, what ones should be changed to help increase exploration?

All but one of the main contributing factors to the observed exploration decline have been adequately discussed elsewhere in this report. As well, recommendations have been made regarding actions government should take in order to change factors that are within its control. The one factor mentioned above which has not been considered is the influence of mineral commodity prices on exploration activity.

It is a common understanding among mineral industry professionals that the sums spent on mineral exploration in any year are dependent on relevant mineral and metal prices in the present and recent past. The purpose of this section is to determine whether the expected relationship is observable in New Brunswick.

7.5.2 Relationship of exploration activity with metal prices

The expected theoretical relationship is explained as follows. The annual budget of the exploration department in a large mining company depends primarily on two factors: the amount of money available and the company's degree of optimism about identified exploration targets. In the junior sector, the exploration budget is almost totally influenced by the money available (the juniors' optimism level is always high!). Money available to both types of exploration organizations clearly depends on mineral prices.

In the case of the large company, retained cash flow is the main source of exploration funding. When prices are high, the company has more cash available for exploration. However, any increase in exploration spending would not be instantaneous, but would lag the price increase by one or two years. There are two reasons for this. First, the company may wish to allow profits to accumulate for a year or two before committing the cash to exploration (there may be competing needs). Secondly, exploration budgets and plans are prepared at least several months before the field season begins and the spending response is delayed accordingly.

In the junior company, cash available at any time is just equal to the amount investors are ready to risk on stock purchases. Investors' readiness to invest is in turn conditioned by price levels, and perhaps even more by price expectations. The post-1980 strength in gold exploration in Canada is an illustration (though there were also policy factors -- flow-through share financing). Again, the investment response is not instantaneous due to the time required to digest the fact of the price increase and prepare funding solicitations.

Globally, therefore, one would expect to see a close correlation between exploration spending and the relevant mineral/metal prices of a year or two previously. Whether this relationship is observable in Canada or in New Brunswick depends on other factors.

The proportion of global exploration funds spent in Canada or any other jurisdiction is not constant, but varies with decision makers' views on mineral potential, business climate, etc. There is considerable evidence that Canada's share of global exploration spending has fallen substantially since the early 1980s (see, for example, the major study carried out by IGWG during 1992-94 which documented these changes). In part, these declines have been attributed to changes in Canada's business climate, and in part to the increased availability of promising business opportunities in areas of high mineral potential (such as Chile).

It is of particular interest for the current study to see whether the expected exploration/price relationship holds in New Brunswick and whether changes in metal prices account for the observed trends in mineral exploration. For comparison purposes, the analysis also includes data for Canada. It is expected that any relationship would be more easily observed for a large geographical area such as Canada. To rule out spurious effects due to inflation, all analysis has been carried out using real (constant-dollar) values of the variables.

The methodology used is as follows (see Appendix C for all data and charts pertaining to this analysis). Time series for real exploration spending in New Brunswick and Canada have been correlated with corresponding time series for real prices of commodities relevant to New Brunswick. Only the prices of the metals copper, lead, zinc, silver and gold were included in the analysis. Potash was omitted because the bulk of exploration spending has traditionally been directed to metal discoveries rather than to industrial minerals. There are four exploration series, each of which is used as the dependent variable in its turn.

a. New Brunswick (excluding overhead)
b. New Brunswick (including overhead)
c. Canada (excluding overhead)
d. Canada (including overhead)

Simple correlations were performed between each of these four series and the price series for each of the five metals taken in turn (metal price as the independent variable) . This produces a total of 20 correlation coefficients for each set of trial analyses. We considered carrying out multiple correlation analysis, relating exploration spending to the prices of several metals at once. However, this option was rejected on the basis that it would give spurious results because metal prices are themselves inter-correlated.

Five sets of trial analyses were carried out:

2. *Exploration expenditures vs metal prices, year-by-year comparison.* In this analysis, the 1957 real exploration expenditure is related to the 1957 metal price, and so on down the line.

3. *Exploration expenditures (lagged one year) vs metal prices.* Here the 1958 exploration expenditure is related to the 1957 price.

4. *Exploration expenditures (lagged one year) vs metal price (difference from previous year).* In this case, the 1958 exploration number is related to the price difference 1958-1957. This was used to determine whether or not a price change has more influence on exploration than the absolute level of price does.

5. *Exploration expenditures (lagged two years) vs metal price (difference from previous year).* This trial relates the exploration figure in 1959 to the price difference 1958-1957. This was tried on the theory that it takes a whole year for the influence of a price change to make itself felt.

6. *Exploration expenditures (difference from previous year) vs metal price (difference from previous year).* Here the year-to-year difference in exploration spending (1958-1957) is related to the price difference between the same years (1958-1957). Similar to the thinking in item 3, it was considered that the dependency of one variable on another may be easier to detect if the absolute level of exploration and prices is eliminated by working with differences in both variables.

Many more combinations could be tried, but these were considered sufficient to determine whether the influence of metal price on exploration can be detected. The results of these analyses are expressed in an array of 100 correlation coefficients. These are shown in Table 7.3. A positive number indicates a direct relationship between the variables (exploration increases as price increases). A negative coefficient indicates an inverse relationship. Those items which are shown in bold typeface are the ones which represent a significant degree of correlation at the 95% confidence level.

This confidence level means that a correlation coefficient as high as the one being considered would not be produced by chance more often than one time out of 20. For the number of data points present in these analyses, the critical level of the correlation coefficient varies between 0.304 and 0.312. For our purposes, any correlation coefficient greater than 0.31 represents a significant relationship between the variables.

The following points are worth noting.

1. Several of the coefficients are negative, apparently implying an inverse relationship between exploration and price. If this implied relationship were real, it would be surprising indeed. However, most of the negative coefficients are relatively weak and can be attributed to inherent variability in the data which obscures any direct relationship between the variables.

Table 7.3: Summary of exploration vs price correlation coefficients
(Bold type indicates significant relationship, italic type indicates negative correlation)

	Copper	Lead	Zinc	Silver	Gold
1. Exploration expenditures vs metal prices (same year)					
a) NB (excluding overhead)	*-0.0852*	0.2652	0.2046	**0.5411**	**0.6234**
b) NB (including overhead)	0.0230	0.2738	0.2254	**0.5200**	**0.3469**
c) Canada (excluding overhead)	*-0.2746*	*-0.0578*	0.0037	**0.3498**	**0.6693**
d) Canada (including overhead)	*-0.2334*	*-0.0622*	0.0177	**0.3647**	**0.6704**
2. Exploration expenditures (lagged one year) vs metal prices					
a) NB (excluding overhead)	0.0675	**0.3741**	**0.3943**	**0.7497**	**0.7138**
b) NB (including overhead)	0.0118	**0.3633**	0.2993	**0.7390**	**0.6953**
c) Canada (excluding overhead)	*-0.2963*	*-0.0298*	*-0.0704*	**0.4437**	**0.6707**
d) Canada (including overhead)	*-0.0675*	*-0.0154*	*-0.0817*	**0.4655**	**0.6732**
3. Exploration expenditures (lagged one year) vs metal prices (diff. from previous year)					
a) NB (excluding overhead)	*-0.2165*	*-0.1577*	*-0.2023*	*-0.2412*	*-0.1102*
b) NB (including overhead)	*-0.1088*	*-0.1370*	*-0.0616*	*-0.2396*	*-0.1131*
c) Canada (excluding overhead)	0.0104	*-0.0213*	0.0763	*-0.1333*	*-0.0215*
d) Canada (including overhead)	0.0201	*-0.0475*	0.1060	*-0.1415*	*-0.0234*
4. Exploration expenditures (lagged two years) vs metal prices (diff. from previous year)					
a) NB (excluding overhead)	0.0332	*-0.0044*	0.0014	0.2962	**0.3317**
b) NB (including overhead)	0.0298	*-0.0297*	-0.0019	0.3073	**0.3982**
c) Canada (excluding overhead)	0.0671	0.0947	0.0384	0.1147	0.2301
d) Canada (including overhead)	0.0699	0.0916	0.0510	0.1209	0.2461
5. Exploration expenditures (diff. from prev. year) vs metal prices (diff. from prev. year)					
a) NB (excluding overhead)	**0.3163**	0.1903	0.2620	**0.6285**	**0.5240**
b) NB (including overhead)	0.1743	0.1292	0.0863	**0.6004**	**0.5690**
c) Canada (excluding overhead)	0.0864	0.1775	*-0.0601*	**0.3816**	**0.3839**
d) Canada (including overhead)	0.0800	0.2141	*-0.0821*	**0.4004**	**0.4108**

Notes:

1. Exploration data are annual exploration spending in constant 1998 Canadian dollars
2. Metal price data are annual average prices in constant 1998 U.S. dollars

2. The strongest direct exploration-price relationships are with silver and gold. This is consistent with the fact that both Canadian and New Brunswick exploration spending peaked in 1981, shortly after peaks in both silver and gold prices. As well, it must be remembered that most of the exploration in Canada in the post-1980 period was directed at finding gold deposits and would be expected to be sensitive to precious metals prices.

3. The best overall correlations arise from analysis No. 2, exploration expenditures (lagged one year) vs metal prices. This is consistent with the findings of other workers, notably those within Natural Resources Canada.

4. In the case of New Brunswick data, the exploration data excluding overhead seems more sensitive to metal price than the series which include overhead. For Canada, the reverse is true.

5. The best correlations for New Brunswick are those in analysis No. 2, relating exploration data (excluding overhead) to the prices of silver and gold. However, significant correlations also exist with the prices of zinc and lead. This is intuitively correct, since zinc, silver and lead are the leading metallic minerals produced in the Province.

How useful are these correlations, really? One measure of "goodness of fit" is the amount of variability in the dependent variable which is accounted for by movements in the independent variable. The fraction of variability accounted for is equal to the square of the correlation coefficient.

At the limit of statistical significance for these data (correlation coefficient of 0.31) only about 10 percent of the variability is accounted for. Thus, even though we can say with confidence that a relationship exists, the usefulness of a marginally significant correlation for predictive purposes is very limited.

When the coefficient rises to around 0.7 or higher, as is the case with precious metal prices, some 50 percent of the variability is accounted for by the correlation. This latter relationship may give some possibility of forecasting next year's exploration activity by this year's silver price, but residual

errors would still be substantial. As well, there is no guarantee that the future will be like the past. For both reasons, a cautious interpretation is advised.

To illustrate these points concerning residual errors around correlations, two "scatter diagrams" are shown in Appendix C.

Figure C-11 plots exploration vs zinc price data corresponding to the correlation coefficient of 0.3943 found in Table 7.3 (analysis 2a, "zinc" column). This correlation accounts for 15.5 percent of the variability in exploration spending. The individual points scatter widely around the calculated trend line .

Figure C-12 plots exploration vs silver price data corresponding to the correlation coefficient of 0.7497 found in Table 7.3 (analysis 2a, "silver" column) This correlation accounts for 56.2 percent of the variability in exploration spending. The scatter of individual points is less pronounced than in Figure C-11, but they still range fairly widely.

7.5.3 Conclusion re metal prices and exploration

The analysis confirms that, as expected, a positive relationship exists between exploration expenditures in a given year and recent metal price history. However, the utility of the relationship in accounting for changes in exploration activity is somewhat weak.

7.5.4 Relationship of exploration activity with non-metallic mineral prices

One could imagine a situation where a rapid price increase in an industrial mineral would raise the interest of explorationists to go out and find more deposits of the commodity. In practice, however, this phenomenon is rarely observed. Because of their geological characteristics (often noted at or near surface, relatively large areal extent) occurrences of industrial minerals are often known for many years before they are developed. The determining factors are usually not exploration knowledge or commodity price but often revolve around resource quality, transportation cost and marketing know-how. As well, and perhaps as a consequence of these characteristics, the largest proportion of exploration spending in any year is directed towards base and precious metals.

For these reasons, no analysis was carried out on the relationship of exploration effort to commodity prices of non-metallic minerals.

7.5.5 Policy implications

There is virtually no scope for the government to influence metal prices. Therefore, no recommendations will be made in this section. However, the government may wish to use recent metal prices as supplementary information in evaluating the causes of changes in exploration activity.

7.6 New Brunswick mineral potential

> *New Brunswick is perceived by industry to have relatively low mineral potential. What are the reasons for this perception and what should the Province be doing to address it?*

The subject of mineral potential was thoroughly discussed in Section 3.6. It will not be further elaborated here. No recommendations are proposed to assist the Government to change the industry's perceptions of mineral potential.

7.7 Strategies for undeveloped deposits

> *Five major deposits (Mount Pleasant, Caribou, Half Mile Lake, Restigouche and Millstream potash) and over 50 small deposits have significant reserves but are uneconomic because of low recoveries, complex metallurgy and low commodity prices. What are the suggested strategies for bringing these deposits into production?*

The 5 major deposits have been discussed in Chapter 2, "Resource Inventory." In particular, it should be noted that these undeveloped deposits are sub-marginal because of their high costs. See Figure 2.1 for a graphic display of their competitive ranking.

The authors believe that no extraordinary policy measures are justified to artificially bring these deposits into production. History shows that subsidized production comes on stream when prices

peak, only to close a year or two later. General competitiveness measures as proposed in our recommendations will improve their chances. Technological improvements, whether developed in New Brunswick or elsewhere, will also help.

7.8 Lack of success in finding a major deposit

> *For the last 40 years, a number of small metallic mineral deposits were found but no major deposits have been discovered. During these years industry spent approximately $10 million/year (1998$) and $2 million/year by the government in support of mineral exploration. What are the causes for not finding a significant metallic deposit during the last 40 years?*

The collection of factors to which the authors attribute this lack of success have been discussed in Chapter 3 (see particularly Section 3.2, "The discovery record"). It is not necessary to elaborate them here.

7.9 Industrial minerals: a question of focus

7.9.1 Introduction: historical overview

The Study's Terms of Reference pose the following issue:

> *In the 1970's, three significant potash deposits were found as a direct result of government investment. Since then, the perception is that government focused more on metallic minerals than industrial minerals. Should the government focus more on industrial minerals?*

It will be convenient to discuss both non-metallic minerals and structural minerals under the single designation of "industrial minerals."

The importance of industrial minerals to the economy of New Brunswick predates the discovery of potash deposits in the 1970s. Indeed, "up until the midpoint of the present century one could say that industrial minerals like grindstone, building stone, gypsum and limestone were the mainstay

of the province's non-fuel mineral industry. However things were to change drastically in the latter part of the 1950s following the discovery and subsequent development of extensive base metal deposits in northern New Brunswick." (Internal report, Geological Surveys Branch, DNRE, no date).

Following the successful development of potash mines in the Sussex area, that mineral became the dominant component of industrial mineral production in the Province. Largely thanks to potash, the value of industrial mineral production climbed from $57.5 million (11% of total mineral production) in 1983 to a record $345 million (36% of total mineral production) in 1996.

Unfortunately, that level of production became impossible to sustain when in mid-1997 water inflow shut down the Potacan operation 20 km south of Sussex. By 1998, the value of industrial mineral production (including structural materials) had fallen to an estimated $227 million. Of that, some 92% was accounted for by only three minerals: potash, peat and aggregates (e.g., crushed stone).

7.9.2 Current production and future potential

Industrial and structural materials currently produced in New Brunswick include: potash, peat, stone, lime, sand and gravel, marl, quartz, salt, and sulphur in smelter gas. As indicated above, the total value of production in 1998 was an estimated $227 million (NRCanada, web site, www.nrcan.gc.ca/mms/efab/mmsd/production/1998/).

Chapter 2 of this report comments on the development potential of industrial minerals in New Brunswick as follows:

> *Limestone, gypsum, anhydrite, silica, diatomite, peat and dimension stone and structural materials are resources which, except for peat, are underdeveloped in the province relative to their potential. As markets grow in the region and alternative sources are sequestered by urbanization, opportunities will occur. These resources, in some cases, can be processed into high value products rather than just shipped in bulk. However, the R & D and marketing factors are crucial to the commercialization in such cases.*

We will use these comments as the jumping-off point for a discussion of the government role in stimulating such development.

7.9.3 Role of government

There is currently considerable interest in industrial minerals (gypsum, construction aggregates, etc.) in New Brunswick. DNRE has experience in working with owners to bring known deposits to commercial development. Unlike base and precious metals, however, the problem is not so much in locating and delineating the deposit, but rather in understanding its chemical and physical makeup and its processing needs, and in assisting with the marketing and promotion of these unique properties in specific applications.

Often, small holders of industrial materials properties do not have the expertise or resources to carry out these functions unassisted. Another constraint is that transportation cost is a limiting factor for bulky materials having a relatively low value. As a result, locational factors are important determinants of economic viability and sometimes only nearby markets can be served.

Therefore, the most effective assistance to holders of industrial mineral properties is that which provides those processing and marketing services which could lead to rapid commercialization. Some of these services can be supplied by provincial government employees (permanent or under contract), but some probably require the services of specialized consultants.

Existing assistance programs such as VAMP (Value Added Mineral Processing) can be directed to technical aspects of characterizing and processing industrial minerals. See Section 4.6.2 for comments on the current utility of VAMP and suggestions for improvement. Other programs of the provincial and federal governments can be used to assist in the development of local, regional and international markets.

The government has shown that it is well aware of these issues. For example, the 1998 report of a government-industry Task Group on Minerals and Materials Technology makes several useful suggestions. As well, internal DNRE documents provided to us state the challenges related to industrial materials with admirable clarity.

7.9.4 Comments and suggestions received

In the interview guide prepared for the Study, the authors included a question as to whether the government had an appropriate balance of effort as between metallic minerals and non-metallics. Unfortunately, relatively few respondents took the opportunity to comment on industrial minerals or the government's role in their discovery, development and marketing. The comments received from industry are recorded in Appendix D. A summary of the main points follows.

There is good potential for industrial minerals in New Brunswick, but we need more effort in understanding market needs and marketing the product. Industrial minerals should be promoted at the International Conference on Industrial Minerals. Market development support is a valid program. Geoscience programs should be designed to facilitate and encourage exploration for a broad range of commodities including industrial minerals. The industrial minerals side of DNRE needs to be strengthened. Mining and geology information marketing efforts of the government should be integrated and a team approach taken.

Resource processing aspects and marketing of the commodity should have more consideration. Since processing is important to industrial minerals, R&D incentives should be improved, including tax incentives to attract the right skills. The range of allowable VAMP projects should be expanded to permit: market research, market development, processing tests, tests of industrial product market acceptability, and ASTM tests to qualify. Also, VAMP is poorly publicized. The province should do market studies, mineral deposit studies and even prefeasibility reports on industrial mineral deposits which are considered to have development potential. These should be then used to attract investors in much the same way as the Economic Development department attracts investors for other targeted businesses such as call centres, etc. Seed funding that is not cost shared is needed to support marketing, preparation of promotional packages and travel.

Because of its unique properties and characteristics, staking of potash claims under the same rules as for metals is inappropriate. Awarding potash rights on a concession basis would make more sense. The Mining Act should allow production of industrial minerals for trial shipments of the size required to evaluate markets before doing an environmental assessment and applying for a mining lease.

Regulatory requirements are onerous for small or first time operators of industrial minerals projects. The government should financially support small operators so that environmental studies can be conducted in order to obtain approvals for advanced exploration programs. This would be analogous to the support small woodlot owners get for tree nursery and silviculture/thinning programs.

Other respondents commented on: a need for better provision of resource information, market potential and prospective development economics via the Internet by doing keyword searches on commonly used search engines; a need for government involvement to better utilize existing shipping facilities and ports; and a need for more openness in DNRE with respect to developing industrial minerals.

7.9.5 Policy implications

As indicated earlier, we believe that DNRE is well aware of the issues and constraints associated with the development of a viable industrial minerals industry. However, government officials may wish to study the industry comments recorded in Appendix D to gain additional ideas and possibly to identify opportunities for improved communication.

Potash is unique among industrial minerals in that its production and marketing structure is more akin to that of metals than to the lower-value materials classified as industrial minerals. The remainder require a family of policies and programs to promote their development.

The necessary measures cut across the mandates of several government departments and agencies. In Chapter 4 it was noted that the government has an interdepartmental committee to facilitate industrial mineral development, but that certain processing skills are lacking. It is unnecessary to repeat here our recommendation that efforts be made to acquire such skills.

8. A Strategic Framework for Government Action

8.1 Introduction

The purpose of this concluding chapter is to summarize our recommendations and place them within a coherent strategic framework. We have covered a large amount of ground and have carried out detailed analysis of diverse policy fields. We have made a number of recommendations arising from our analysis. It is appropriate to show how these relate to each other and how they work together to assist the government in its task of revitalizing the New Brunswick mining industry.

This strategic framework first sets out a challenging but achievable objective for the future of the New Brunswick mining industry. It then outlines the conditions that must be met if that objective is to be realized. The necessary conditions will only be fulfilled if industry and government take concrete actions. Finally, we attempt to show how each of our recommendations will contribute to the necessary actions in support of the objective.

8.2 The objective

During the course of this study, the Steering Committee suggested the following objective:

> *Maintain or increase the current value of production ($860 million plus), as well as the current level of taxes, royalties and employment.*

In the face of projected closure of the Brunswick mine within ten years and the absence of known resources of equal quality, the government's objective is indeed a challenging one. We feel that the suggested objective can be met, given the right mixture of favourable government policies, entrepreneurial effort, and luck. We therefore endorse it, and have built our study around recommendations which we hope will assist government to do its part.

8.3 Conditions for success

To achieve the suggested objective, some or all of the following broad conditions must be met:

- One or more large viable base metal discoveries must be made (or an equivalent number of smaller deposits).
- Alternatively, a processing technology breakthrough may make known base metal deposits viable, but the probability of this is unknown at present.
- Proposed technical modifications to the Belledune smelter must be successful and profitable (or a new source of conventional feed must be found).
- Favourable gold showings recently found in southern New Brunswick may result in the development of one or more viable precious metals mines.
- The pace of industrial mineral development must be stepped up.

All of these depend on human effort. For example, new discoveries will not occur unless prospectors, juniors and producers continue and increase their exploration effort. Industrial mineral deposits will not be developed unless entrepreneurs are enabled to make the necessary technical and marketing studies. Technological advances will not be made, or applied to New Brunswick problems, unless scientists and engineers direct their work to relevant areas.

8.4 Strategic role for government

Government cannot legislate these actions in the mining industry. But it has a number of levers that can influence private-sector behaviour. It can encourage desired actions by providing incentives and discourage unwanted actions by taxing them or regulating under the threat of sanctions.

Our recommendations are designed to assist the government to push and pull at the mining "system" in order to induce the appropriate actions and thereby improve the chances of meeting the defined objective. Taken together, these recommendations constitute a strategy that the government can implement in working towards the objective of maintaining or increasing the current level of activity in the sector.

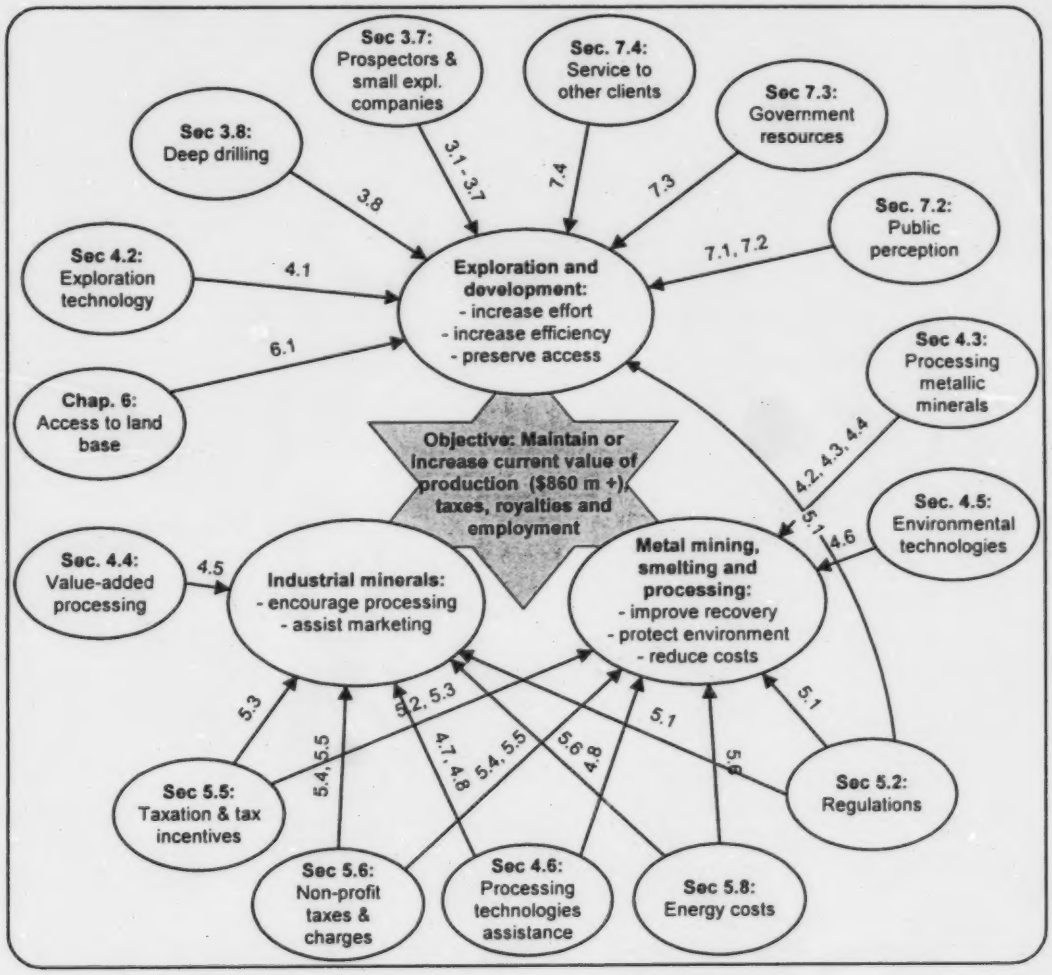


Figure 8.1: Strategic framework for government action

The strategy is shown in schematic form in Figure 8.1. Three pillars of private-sector activity support the objective: exploration and development; industrial minerals; and metal mining, smelting and processing. Around these pillars are grouped the 15 policy fields through which the government can influence the amount or quality of industry activity. Each arrow represents one or more recommendations and is labelled with the recommendation number(s). Each originates in the relevant policy field (section of the report) and is linked to the pillar(s) of private-sector activity it influences (recommendations 7.3 and 7.4 apply to all pillars, but are not graphically linked to metals and industrial minerals to avoid complexity).

8.5 Elements of a strategy

Our recommendations relate to two types of government policy. ***Sectoral policies*** are directed exclusively at the exploration and mining industries. ***Framework policies*** apply more broadly, covering several sectors or the whole economy. They constitute an important part of the overall investment climate. Examples of framework policies include income tax, government charges and levies, and environmental regulation. By definition, all three of our mineral industry pillars are affected by framework policies, whereas sectoral policies may be specific to one or another pillar.

Here is a brief resumé of our recommendations in relation to policies as they apply to the three industry pillars. Note that as some recommendations apply to two or more pillars (particularly in the case of framework policies) there will be some repetition.

Exploration and development can be strengthened by:

- developing a larger number of active prospectors (recommendation 3.1)
- providing more reports on mineral occurrences by commodity (3.2)
- implementing electronic access to technical data (3.3)
- creating a 25% tax credit against cost of shares to finance exploration in New Brunswick (3.4)
- replacing NBEAP with the above tax credit if successful (3.5)
- rewarding success with tax benefits rather than front end incentives (3.6)
- involving the Premier in future major mining conferences (3.7)
- matching surface drilling expenditures to year 2008, to the limit of government revenue from MMTA (3.8)
- encouraging and assisting private-sector and academic research into novel exploration techniques (4.1)
- organizing a meeting of senior management of DNRE and other relevant departments collectively with industry leaders to review regulatory concerns (5.1)
- preserving land access for exploration and mining (6.1)
- considering, in cooperation with industry, a communications program featuring factual mining industry information (7.1)
- continuing to promote both mining and eco-tourism, where possible combining these interests (7.2)

- preserving and enhancing the financial resources government devotes to mining and minerals (7.3)
- reviewing the legislative mandate and budget of Minerals and Energy Division to finance services rendered to other branches of government (7.4)

The ***metal mining, smelting and processing industry*** can be strengthened by:

- sponsoring a technology seminar on tailings reprocessing (4.2)
- continuing to monitor metallurgical developments of potential application to fine-grained ores (4.3)
- when warranted by new base metal deposits and international conditions, promote research and investment in metallurgical technology (4.4)
- participating in the base metal smelter strategic options process (4.6)
- sponsoring a technology seminar on mineral processing (4.8)
- organizing a meeting of senior management of DNRE and other relevant departments collectively with industry leaders to review regulatory concerns (5.1)
- reviewing the MMTA to make it more competitive with other jurisdictions (5.2)
- reviewing the Capital tax with a view to eliminating it (5.3)
- reviewing provincial non-profit charges and levies (5.4)
- taking a leading role with other jurisdictions to reduce non-profit charges and levies (5.5)
- working in all ways to keep energy costs down (5.6)
- maintaining government resources directed to the mineral sector (7.3, 7.4)

The ***industrial minerals*** sector can be strengthened by:

- adding processing skills to the interdepartmental team promoting industrial minerals (4.5)
- offering unmatched grants to $5,000 under VAMP for preliminary technical studies (4.7)
- sponsoring a technology seminar on mineral processing (4.8)
- organizing a meeting of senior management of DNRE and other relevant departments collectively with industry leaders to review regulatory concerns (5.1)
- reviewing the Capital tax with a view to eliminating it (5.3)
- reviewing provincial non-profit charges and levies (5.4)
- taking a leading role with other jurisdictions to reduce non-profit charges and levies (5.5)

- working in all ways to keep energy costs down (5.6)
- maintaining government resources directed to the mineral sector (7.3, 7.4)

8.6 Conclusion

This concludes our study of the "New Brunswick Mining Industry". We have carried out a detailed analysis of relevant factors. We have made 20 recommendations to the government to strengthen the industry and improve the odds of maintaining mineral-related activity at current levels.

Due to the probabilistic nature of mineral discoveries, we cannot be certain that these actions will achieve the objective. We do believe, however, that together they constitute an effective and prudent strategy which is within the government's capacity to implement.

We are concerned that existing resources devoted to the mineral sector are minimal in comparison with those devoted to other resource sectors within New Brunswick, as well as in comparison with those devoted to minerals by other jurisdictions. Recognizing the government's need to constrain expenditures, we have not suggested expensive new programs. On the other hand, we believe some internal rebalancing in favour of minerals is needed and would be very concerned if resources allocated to minerals were reduced.

This report is respectfully submitted.

Appendix A: Exploration Incentives in Canada

This Appendix describes the exploration incentive programs of Canadian provinces and territories and forms the basis for Tables 5.1, 5.2 and 5.3 There are no federal exploration incentive programs (as defined here).

The term "exploration incentive" is understood to refer to any financial incentives, such as government grants and other contributions to prospectors and exploration organizations, designed to promote mineral exploration. Tax incentives expressly designed to promote mineral exploration also qualify. However, tax measures designed to promote non-exploration investment, such as processing allowances, are considered in another section, "Taxation". Table 5.1 at the end of the current section displays the chief features of exploration incentive programs offered by Canada's provinces and territories.

A few jurisdictions offer direct financial assistance for mining or processing activities beyond the exploration stage. Such programs may be said to influence exploration decisions, but only indirectly. A tabular display of all identified incentive programs of this kind is contained at the end of Section 5.4.

In addition to any financial and tax-based incentives offered, all jurisdictions provide in-kind support for mineral exploration through geological mapping and other relevant government services.

Description of provincial/territorial programs

Alberta

The Province offers no system of direct grants or other financial support for non-energy mineral exploration. Alberta is rich in solid energy minerals such as oil sands and coal. Their exploration and discovery characteristics are dramatically different from those of industrial minerals and metals. Because of these deposits' vast areal extent, the problem of the "needle in the haystack" does not exist. Conventional exploration incentives are inappropriate for these sectors and are not offered in Alberta.

British Columbia

B.C. offers a *Prospectors Assistance Program*, which gives grants to qualified prospectors in order to encourage grassroots prospecting in British Columbia. The Program contributes up to 75 percent of the eligible costs of a proposed prospecting program to a maximum of $10,000. Successful applicants receive 50 percent of their approved funding up front with the remaining 50 percent being paid after completion of the field work and submission and approval of a prospecting report form.

Applicants must have completed a recognized prospecting course or have a working knowledge of prospecting techniques gained through experience. They must hold a valid Free Miners Certificate. A minimum of 30 days prospecting must be completed by the applicant himself or herself. The exploration program must be carried out in British Columbia.

The program is approved on a yearly basis by the legislature. The annual allocation has stood at $500,000 for several years.

There is also a "*Mining Exploration Tax Credit*", of benefit to taxable entities. As part of the "Mining Initiative" designed to make BC more attractive to mining exploration and investment, the Province introduced a refundable mining exploration tax credit (METC) worth up to $9 million annually. Expenditures made by eligible BC residents (e.g. prospectors) and corporations subject to BC tax who conduct grassroots mineral exploration in British Columbia may qualify for the Mining Exploration Tax Credit. A tax credit of 20% of eligible expenditures (net of any assistance received from other programs) may be claimed when filing the T-1 individual or T-2 corporation tax return. The credit is refundable to the extent it exceeds the taxpayer's income tax payable.

Manitoba

Manitoba maintains two exploration incentive programs: the Mineral Exploration Assistance Program and the Manitoba Prospectors Assistance Program. These are detailed below. In addition, there is a "Specialty Minerals Incentive Program" to assist companies to evaluate the economic potential of existing non-fuel specialty mineral (mainly industrial minerals) deposits and market those resources more effectively. This last program is discussed in the next section under "Processing technology incentives".

The *Manitoba Mineral Exploration Assistance Program (MEAP)* provides financial assistance for non-fuel mineral exploration in Manitoba. The program is available to qualified companies or individuals proposing exploration projects in Manitoba.

The program provides assistance of up to 25% of approved eligible expenses to a maximum of $300,000 per recipient, per fiscal year. The program offers a higher percentage for projects proposed in the Northern Superior Region of Manitoba, up to 35% of approved eligible expenses to a maximum of $400,000 per recipient, per fiscal year. The higher percentage for the Northern Superior is in consideration of the region's limited infrastructure and higher cost of conducting exploration. The higher percentage for Lynn Lake/Leaf Rapids is in consideration of mine closures over the next three years and the region's designation as a Community Mine Watch Area. An evaluation will be conducted for the region annually. Total assistance under MEAP will not exceed $400,000 per recipient, per fiscal year (April 1 to March 31). Funding of up to $8.25 million has been identified for the Mineral Exploration Assistance Program (MEAP) for a three-year period beginning April 1999. The Program will make $2.75 million available each fiscal year beginning in 1999/2000. The final $2.75 million will be made available in 2001/2002.

The *Manitoba Prospectors Assistance Program (MPAP)* offers up to $7,500 per year to qualified applicants to encourage exploration for mineral deposits by prospectors in Manitoba. Applicants must hold a Manitoba Prospecting Licence, be experienced and self-employed, have a prospecting project within Manitoba on mining claims held by the applicant or open Crown mineral land, have a prospecting target that may include rocks or minerals other than crushed rock for construction purposes, sand, gravel, natural gas and petroleum. Maximum assistance is 50% of the expenditures incurred up to $7,500. An applicant may only hold one grant per year. Funding for the Program is set at $125,000 per year for three years, to March 31, 2002.

New Brunswick

The Province of New Brunswick offers two exploration incentive programs, the *Mineral Exploration Stimulation Program* (MESP) and the *New Brunswick Exploration Assistance Program* (NBEAP).

MESP is designed to assist individual New Brunswick prospectors and junior exploration companies with small-scale exploration projects. The program supports grass-roots exploration activities. Grants of up to $3,000 per prospector per year are made to support costs such as meals, chemical analyses, mileage, etc. Wages are not valid expenses under the program. The total annual budget for MESP is $40,000.

NBEAP provides up to 50% of the cost of an approved project to a maximum of $40,000 contribution. The minimum amount contributed per project is $10,000. Remaining costs of the project are borne by the applicant, either in cash or "in-kind" work. To be eligible for the program the applicant must be a junior mining company defined as a company whose principal business is mineral exploration and development and which does not have a self-sustaining cash flow from operations. The applicant must not be a subsidiary of a major mining company, but it must hold mineral rights or an option to the lands considered in the application. A total of $350,000 in provincial and federal funding is allocated to the New Brunswick Exploration Assistance Program for 1999.

Newfoundland

The Province offers two exploration incentive programs: the Prospectors Assistance Program and the Junior Company Exploration Assistance Program. A third assistance program, designed to promote the dimension stone industry, is described in the next section under "Processing technology assistance."

The *Prospectors Assistance Program (PAP)* is a provincially-funded program which provides training and direct financial support to individuals. The program has two components: Prospector Training and Prospecting Grants. The Department of Mines and Energy provides professional instruction and other resources to a comprehensive training course in basic prospecting skills. The tuition-based course is delivered annually in late spring through the provincial community-college system. Prospecting grants constitute direct financial assistance to eligible prospectors involved in independent mineral-exploration activity. Approved projects on Crown Land or the proponents' registered claims are supported by grants up to $4,000 for eligible prospecting expenses. The annual cost of the PAP program is unknown.

The *Junior Company Exploration Assistance Program* provides a total of $1.5-million per year in government funding to defray 50% of approved eligible costs, to a maximum of $100,000 per undertaking, on advanced mineral exploration projects by individuals or junior mineral exploration companies registered to do business in the province.

Nova Scotia

The Nova Scotia *Prospector Assistance Program (PAP)* brings together three inter-related components: training, prospector assistance and marketing assistance (marketing of mineral

properties). The Program is funded by the Economic Diversification Agreement which is jointly administered by the Nova Scotia Department of Economic Development and Tourism and Atlantic Canada Opportunities Agency (ACOA). The Agreement has a value of $600,000 over four years. It is cost shared 60-40 by the federal and provincial governments and will end in 2001. For the fiscal year 1999/2000, funding allocated to all components totals $190,000.

The *training component* provides funding for basic and advanced prospecting courses in addition to seminars, workshops and field trips. In the year 1999/2000 a sum of $20,000 has been allocated to prospector training.

The *prospector assistance component* provides direct funding to prospectors. An individual prospector or a prospector's company is eligible for up to a $5,000 contribution from PAP as long as the prospector contributes the equivalent of 30 percent of the grant amount. For a maximum $5,000 contribution from PAP, a prospector must contribute $1,500. For the year 1999/2000 the funding allocation for this component is $140,000.

The *marketing assistance component* provides funding assistance to prospectors to market their mineral properties to junior and senior mining companies in local and national trade show venues. This component of the PAP contributes up to $1,600 for individual prospectors to travel to trade shows and display information about their properties. In addition, the PAP funding assists with the expenses of renting display hardware and space. For 1999/2000, funding support for marketing is set at $30,000.

Ontario

The *Ontario Prospectors Assistance Program (OPAP)* provides financial assistance to qualified individuals to support prospecting and exploration activities. Financial assistance is in the form of a maximum grant of $15,000 per year. A payment of 50% is made upon approval with the balance on submission and approval of the Final Submission Form, reports and maps after completion of the project. Funding is not automatic. Acceptance of projects is based on an applicant's experience and training, quality of proposal, references, and past OPAP performance if applicable. Unlike the Nova Scotia program, OPAP does not require the Prospector to put up matching funds or in-kind work to qualify for a grant. The annual OPAP budget is $4 million.

According to recent media reports, the OPAP program may be discontinued. The authors did not obtain verification of this report from Ontario officials.

Prince Edward Island

Prince Edward Island has little perceived mineral potential and appears to have no incentive programs to encourage mineral exploration in the Province.

Quebec

Quebec offers a number of programs designed to stimulate mineral exploration:

1. *Flow-through Shares* to sustain mineral exploration in Quebec;
2. *Assistance for Bringing an Orebody into Production* for small and medium-sized companies;
3. *Mineral Exploration Assistance Program* which has three components:
   a. Part A, applying to prospectors
   b. Part B, applying to companies exploring in Quebec;
   c. Part F, a program for *Native Mining Entrepreneurship Development*
4. *Near-North Mineral Exploration Program* for companies exploring in that region;
5. *Program of Deep Drilling in the Abitibi Sub-province;*

Quebec is the only province to maintain a system of *Flow-through Shares* to provide tax incentives to promote investment in, and exploration by, junior mining companies. If an individual Quebec taxpayer invests in the "flow-through" shares of a non-producing exploration company to finance an exploration program, the company renounces its tax deductions associated with the exploration expenses to the investor. He may then apply these deductions against his personal taxation.

Any Canadian investor may deduct 100% of these expenses against his federal tax and provincial tax. The extra incentive for Quebec residents arises from the fact that the investor may claim 125 percent of the actual expense (if incurred in Quebec) as a deduction against provincial tax. That multiplier rises to 175 percent in the case of surface exploration.

Several features of the Quebec flow-through regime are more advantageous to the investor than the earlier Canadian system in place until 1987. For one thing, the maximum multiplier under the earlier scheme was 150%. For another, the period for completion of the exploration work is the end of the year after the year in which the funds were invested (the former Canadian system called for completion within 60 days following the year of investment). Moreover, when the shares are re-sold, any capital gain is calculated using an "adjusted cost base" of zero, and the gains are tax-exempt for Quebec taxes. Furthermore, flow-through deductions are not included in the calculation of the alternative minimum tax for Quebec taxation (up to a maximum of $25,000 in flow-through

shares). For Quebec investors with a taxable income over $60,000, the net effect is that the federal and provincial governments bear a total of 72% of the cost of the investment. The total cost of this program, in terms of foregone tax revenue, is not available.

The program of *Assistance to Bring an Orebody into Production* is designed to help qualified small and medium-sized mining firms that have discovered a promising orebody to bring it to the production stage. The program is not strictly an exploration incentive program as we have defined them. However, it is worth mention here because of its size and because it is a further indication of the commitment demonstrated by the Government of Quebec to the mineral industry.

This credit, created under the *Mining Duties Act,* is meant to offset the costly due diligence obligations undertaken by small and medium-sized businesses when seeking the partnership of financial institutions. The credit came into force on June 13, 1996 for a period of five years.

Under the program, the government can pay a qualified firm an amount of up to 12% of the projected capital costs (roads, buildings and equipment) with a maximum of $3 million. The credit is payable **after** the financial institution has invested in the firm. To be qualified, the recipient firm must: have its head office in Quebec or carry out its activities principally in Quebec; have assets of less than $50 million or net shareholders' equity of less than $40 million (taking into account related persons or firms); and have ownership of at least 30% of the depreciable property used to bring the orebody into production. This minimal interest must be retained for at least 4 years. The total cost of the program in terms of lost revenue is unknown.

Part A of the Quebec Mineral Exploration Assistance Program provides assistance to prospectors. A maximum amount of $4,000 per year may be granted to an individual to support basic prospecting work on non-staked land or on new claims. Of this, $3,000 may be allocated for general prospecting expenses and a daily allowance. An amount up to $1,000 may be used to cover a geologist's consulting fees. Two prospectors can join forces and obtain a grant of $8,000. An advanced exploration project held by an independent prospector or group of co-owners may qualify for a grant of $15,000. Applications are reviewed by an evaluation committee. The total annual cost of the prospector program is $1.4 million.

Part B of the Quebec Mineral Exploration Assistance Program applies to exploration by companies anywhere in Quebec except for the Near-North region, the territory covered by the program described below. Any mining company doing work in Quebec can receive financial assistance. The

project must be submitted by a certified professional geologist or geological engineer. The program refunds 50% of approved mining exploration expenses incurred by a company, up to $50,000 contribution per project. A company may submit more than one project per year. Admissible work includes stripping, blasting, line cutting, sampling, drilling, geological, geochemical, and airborne geophysical surveys. Underground exploration is excluded. A report must be submitted within 60 days after completion of the work. The reimbursement is claimed after the work is completed. The annual cost of this component is $1.6 million.

Part F, the Quebec *Native Mining Entrepreneurship Development Program*, applies to the North Shore and Far North regions of the Province. The government's goal is to promote mineral exploration activities in these territories by involving Aboriginal people. The chosen mechanism is the creation of mineral exploration funds in Aboriginal communities. Once in place, the fund encourages Native people to participate in mineral resource development; it develops mineral exploration expertise within the community; and it promotes the creation of Native exploration companies.

The program financially supports these community mineral exploration funds. Support can be given for the following activities: promoting mineral potential; increasing the awareness of Native communities with respect to mineral exploration; carrying out training activities; prospecting and exploration activities; providing technical and geological assistance for prospectors; creation of exploration companies.

After reaching an agreement with the representatives of the Aboriginal community, the government deposits the financial assistance in a legally constituted organization (the mining fund) directed by a representative board of directors. The program allocates a maximum of $300,000 per fund per year. The community must also contribute to the fund. The total annual cost of the program is $900,000.

The *Near-North Mineral Exploration Program* is essentially similar to the above program, except that financial assistance can reach $100,000 for exploration carried out in the specified region. The applicable territory lies north of Matagami and Chibougamau to latitude 55° N, and as well includes part of the North Shore. The total annual cost of this program is $1.1 million.

The Quebec *Program of Deep Drilling in the Abitibi Sub-province* recognizes that mineral deposits remain to be found in well-explored regions, but that finding them requires expensive techniques,

notably deep drilling. The government offers reimbursement to mining companies for 50% of actual and approved drilling costs in holes longer than 400 metres. The maximum grant is $50,000 for holes between 400 and 1000 metres, and $75,000 for drilling beyond 1,000 metres. Only drilling costs beyond the first 400 m are covered.

Targets must be relatively well-defined by geological or geophysical means. Applications are scrutinized by teams of two government geologists. A company may apply for assistance for more than one hole per year. A final report must be submitted within 60 days after completion of the work. The total annual cost of the program is $1.3 million.

Saskatchewan

Saskatchewan has no exploration incentive programs. In this respect the Province's policies are similar to those of Alberta and Prince Edward Island.

Northwest Territories

Under the *Prospectors Grubstakes Program*, the NWT government provides up to $8,000 to qualified prospectors to promote mineral exploration by NWT residents. Funds may be used to offset the costs of prospecting including air charters, camp supplies, equipment rental, field assistant salaries, assaying and fuel. Prospectors must have taken an approved prospecting course, made expenditures while prospecting totalling $5,000 or more in the past three years, or been employed as a prospector for at least 20 weeks in the past three years. Grubstake recipients will be required to prepare a basic report of their prospecting activities, daily log and an expense summary following the 1999 field season. The annual cost of this program is $75,000.

Nunavut

No information was available from the Government of Nunavut regarding any exploration assistance program.

Yukon

The Yukon Mining Incentive Program (YMIP) contains three modules:

- *Grassroots - Prospecting.* Qualified prospectors may apply for a contribution of up to $10,000 per year to cover basic operating expenses while searching for new mineral occurrences in the Yukon. One hundred percent of approved expenses are reimbursed.

- *Grassroots - Grubstake.* Companies or individuals providing prospectors with a grubstake (basic operating expenses while searching for new mineral discoveries in the Yukon) may apply for a contribution of up to $10,000 per prospector, per year. Reimbursement is at the rate of 75 percent of approved expenses.
- *Target Evaluation.* Individuals, partnerships or junior companies undertaking basic exploration work directed at appraising the potential of an unevaluated occurrence or target may apply for a contribution of up to $20,000 per year. The intent of this funding is to allow prospectors to evaluate new occurrences following discovery and to prepare them for option or sale. Reimbursement is at the rate of 50 percent of approved expenses.

The three components of YMIP combined had a total contributions budget of $378,000 for each of the last three years. The allocation of this total to the different components varies from year to year, depending on the quality of exploration programs submitted under each category.

In addition to YMIP, Yukon offers the *Yukon Mineral Exploration Tax Credit* which came into effect April 1, 1999. The program provides a refundable tax credit of 22% of qualifying exploration expenditures made by eligible individuals or corporations conducting off-minesite mineral exploration in the Yukon. The cost of this measure is not available.

Appendix B: Public Perception – Detailed Findings

Introduction

The Terms of Reference note that

> *The perception is that the mineral industry (including metallic minerals, industrial minerals and hydrocarbons) is a "low-tech, sunset industry" and an environmental hazard. What should the Province do to overcome this perception? Can it continue to promote its mineral industry and eco-tourism at the same time?*

The purpose of this section of our report is to review available data on public opinion regarding the mining industry and to provide suggestions as to possible actions by the Province. This Appendix presents the detailed findings of our review of relevant polling data. For our analysis of public policy implications and recommendations derived from it, see Chapter 7, Section 7.2, "Public perception of mining."

The basis for this analysis is a series of national and provincial polls which have been sponsored in the past ten years by industry and government. These surveys have been kindly made available to us by The Mining Association of Canada the New Brunswick Mining Association, and Natural Resources Canada. In chronological order, the surveys are as follows:

1. "Canadians' Perceptions and Attitudes Towards the Mining Industry and Related Policy Issues", prepared for The Mining Association of Canada by Angus Reid Associates Inc., June 1989. This survey sampled the Canadian public generally but, unlike other surveys, it added a special sample of 200 individuals living in mining communities.

2. "1993 National Public Opinion Survey on Natural Resources", prepared for Energy, Mines and Resources Canada by Corporate Research Associates Inc., 1993. This survey, as well as surveys mentioned under items 4 and 7, covered forestry and energy sources (including oil and gas) in addition to minerals.

3. "Public Opinion on Key Mining Industry Communications Messages", prepared for The Mining Association of Canada by Decima Research, August 1993.

4. "New Brunswick Mineral Policy Public Opinion Survey, 1994", prepared for the Canada-New Brunswick Agreement on Mineral Development Opportunities Program by Corporate Research Associates Inc., May 1994

5. "A Survey among Opinion Leaders on Mining Industry Issues", prepared for The Mining Association of Canada by Compas Inc., March 1995. This report compared its findings with those of a corresponding 1989 Compas survey.

6. "A Qualitative Research Report on the Keep Mining in Canada Campaign", prepared for the Mining Association of Canada by Decima Research, February 1996

7. "Tracking Survey of Canadian Attitudes Towards Natural Resources Issues, 1997", prepared for Natural Resources Canada by Corporate Research Associates Inc., 1997

There were a number of differences in the design of these surveys regarding the target publics covered, the number of individuals polled, the geographical scope of the survey, the nature of the questions asked, etc. These differences are highlighted in Table 7.1 (Chapter 7, page 7.9). As well, the methodology of analysis varied to some extent among the consultants' reports.

The surveys also exhibited certain important similarities. A number of common themes (e.g., environmental issues) were dealt with by all surveys. Other issues were discussed in two or more surveys. In some cases (items 2, 4,and 7 and item 5) direct longitudinal or geographic comparisons are possible because surveys were directly modelled on each other.

As a result of these similarities, therefore, and despite the differences, we can offer some fairly robust generalizations about the public perception of mining in Canada and the way it has evolved over time. We give below some findings regarding the opinion of Canadians on a number of issues connected with mining.

It is not practical here to summarize the findings of all the surveys on all issues. We will limit our discussion to those issues which have been suggested or implied by the passage quoted above from the Terms of Reference:

- ***The perception is . . .*** It is important to know who perceives what. Are there certain stable currents of opinion in Canadian society, or do some people have one opinion of mining today and another next year? What common characteristics are shared by opponents (or allies) of mining? Do opinions differ in different regions of Canada? How does opinion segment along demographic and geographic lines? The perceptions of opinion leaders could be very influential: what do they believe? and *who* do they believe?
- ***The mineral industry is low-tech . . .*** What do Canadians believe about the industry's production methods? How modern and safe is the industry considered to be?
- ***The mineral industry is a sunset industry . . .*** What is the industry's economic contribution today and what will it be in the future?
- ***The mineral industry is an environmental hazard . . .*** Is the public concerned about the mineral industry's environmental impact? Do people feel the industry is working to improve its environmental record? Does mining conflict with other land uses such as conservation?
- ***Provincial response to these perceptions?*** What should the Province do to overcome negative perceptions? Can it continue to promote its mineral industry and eco-tourism at the same time? Recommendations in answer to these questions are found in Chapter 7.

Top-of-mind impressions of the mineral industry

What is the first image of mining that pops into the Canadian mind? Three surveys asked respondents to give their overall impression of mining without suggesting particular issues.

The 1989 Angus Reid study asked respondents to state what they believed to be the important strengths and achievements of the industry, and also its major weaknesses or shortcomings. Only 43% of Canadians were able to find something good to say (61% in mining communities), whereas 54% (64% in mining communities) were able to come up with a weakness. The three leading top-of-mind strengths were: "develops and markets natural resources" (14% nationally, 12% in mining communities), "creates jobs" (11% and 21%), and "good for the economy" (8% and 7%). The three most significant top-of-mind criticisms were: "harms environment" (20%, 21%), "poor worker

safety" (10%,8%), and "foreign-controlled" (5%, 4%). The relative ranking of these strengths and criticisms did not differ among the three attitudinal segments (pro-industry, antagonist and non-committed).

The Decima 1993 report asked respondents to what degree their opinion of the mining industry was favourable or unfavourable. Some 52% have a somewhat or very favourable opinion as compared with 15% having a somewhat or very unfavourable opinion and 29% neutral.

The 1994 New Brunswick study carried out by Corporate Research Associates (CRA) asked respondents to name (unprompted) one or more of the mining companies operating in the Province. Over one-third could not name a single one, while the largest (Brunswick) was named by only 31% of residents. When asked to give a general impression (favourable or unfavourable) of these companies, on average 42% of respondents gave a favourable opinion as compared with 10% unfavourable and 47% who could not give an opinion.

Comment

This top-of-mind evidence suggests that Canadians and New Brunswickers do not think often about mining. When prompted to do so, most have a relatively balanced view of the mineral sector. They appreciate the economic contribution of the industry, and substantially more report a favourable impression than an unfavourable one. However, they are not blind to perceived shortcomings in the areas of environment and worker safety.

Segmentation of the Canadian public into like-thinking groups

Only one report, the 1989 Angus Reid study, contained a segmentation or "cluster analysis", in which subgroups within the public are identified according to the consistency of their responses. This multivariate technique is designed to isolate particular groups of persons who think very much alike about mining, almost regardless of the issue being considered in a given question. This feature is particularly valuable in shedding light on consistent currents of opinion. In some ways it is more informative than an analysis which simply considers all responses to be independent of each other.

The 1989 survey "identified three distinct groups within the Canadian population which hold distinctively different opinions and attitudes towards the Canadian mining industry." The "pro-industry" group (35% of the population) hold generally favourable attitudes towards the mining industry. The "antagonists" (20%) hold consistently negative attitudes. The largest group (at 45%) hold differing opinions on different mining issues. Reid labelled this group the "concerned". For our purposes, we refer to them as the "non-committed".

The pro-industry segment amounts to 35% of the population, consisting of individuals who are generally sympathetic to the industry, regardless of the issue. They are the "converted": they recognize the economic contribution of the industry and they feel that the industry has made great strides in both environment and treatment of employees. They tend to trust industry spokesmen and accept that the intentions of the industry are good. Demographically, this group contains a disproportionate number of men and persons over the age of 35. Members generally have higher levels of education and higher household incomes than members of the other attitudinal segments. A majority (58%) of the residents of mining communities surveyed belong to the pro-industry segment.

The anti-industry segment, or antagonists, form only 20% of the population. They are consistently negative in their attitudes to industry. They give poor ratings to the industry's environmental record and its treatment of employees and communities. They consider mining industry executives untrustworthy. Women are slightly more likely than men to be Antagonists. Antagonists are also over-represented among NDP supporters.

The third segment, the "non-committed", represent the largest group at 45%. Individuals in this group tended to give the industry a mixed report card, depending on the issues presented to them. They are concerned about the environmental record of the industry, but feel that mining companies are good employers. They tend to trust industry executives and believe that the industry is generally responsible in its community relations. This group contains a disproportionately larger number of women than men. Age composition is similar to that of the population as a whole. This is the least well educated of the three segments with over half never having attended university.

Both the pro-industry sympathizers and the antagonists can be expected to maintain their attitudes over time, because they are relatively impervious to new information. The non-committed

individuals have their doubts about the industry's performance, but they are prepared to listen and are open to objective information about the mining industry.

Other surveys, while not consistently emphasizing attitudinal segmentation, noted at various points that the highest degree of knowledge about and sympathy with mining tends to be concentrated among older Canadians, men, the better educated and anglophones.

Comment

Several conclusions arise from this discussion of opinion segmentation:

a. It is helpful for many purposes to recognize that three distinct and relatively stable currents of opinion about the mineral industry exist within Canadian society and tailor our conclusions and communications accordingly.

b. Neither the pro-industry nor the anti-industry group is a fruitful target for public relations work. Any information that is designed to influence public opinion should focus on the non-committed group, taking its characteristics, interests and concerns into account.

c. As we interpret the results of surveys, it is well to keep in mind that a swing of a few percentage points on any issue is likely to represent a shift of opinions **within** the non-committed group rather than in the population as a whole.

Opinion leaders: a special segment of the public

In 1989, and again in 1995, The Mining Association of Canada commissioned Compas Research (Compas) to carry out an "elite" survey of Canadian decision leaders. The respondents were selected from the following groups: senior federal and provincial civil servants and political advisors, journalists (including parliamentary reporters), consulting academics and other media influencers, business leaders (including financial institutions), and members of labour, native and environmental groups. While only the 1995 survey is referenced (as item No. 5) in this study, the Compas 1995 report contains comparative data from the 1989 survey.

The industry communications program called Keep Mining in Canada and its successor, Mining Works for Canada, were designed to ensure that opinion leaders were kept informed about the industry and about the views of those, such as residents of mining communities, whose present and future livelihoods depend on the industry.

After the Keep Mining in Canada program had been in existence for about 3 years, another elite survey, a qualitative study of the program's effectiveness, was carried out by Decima research. This consisted of a survey of a limited number of federal legislators and their assistants (referenced as study No. 6).

The issues covered by these two "elite" surveys are similar in many respects to those covered by the national surveys cited. Accordingly, their findings will be discussed under individual topics such as the economic impact and future prospects of the mining industry, environmental impact, technology, etc.

Comment

Opinion leaders' impressions of the mining industry are extremely important, as they are well placed to influence the course of future government policy. In principle, these leaders ought to be better informed than the general public about important industrial sectors. Whether they are better informed or not, they may well have opinions and attitudes that could have a major impact on the future of the industry in Canada. It is for this reason that a knowledge of their opinions is needed.

Regional differences

In the Angus Reid 1989 study, BC showed the highest proportion of pro-industry respondents (43%), while Quebec showed the lowest (24%). The antagonists were strongest in Quebec (25%) and weakest on the Prairies (12%). The largest proportion of non-committed was in the Prairies at 51%, and the smallest in BC at 35%. Atlantic Canada respondents mirrored the Canadian averages at 36% pro-industry, 46% non-committed and 18% antagonist.

This study also found that residents of mining communities (who are likely more knowledgeable than the general public) have a more favourable opinion of mining than Canadians generally. They were equally concerned about the industry's environmental impact, but tended to trust industry executives more and were much more likely to believe that industry is making progress in controlling its impacts. This finding was mirrored in the 1994 New Brunswick study which found that mining community residents had more positive attitudes than others in the province.

In the Decima 1993 survey a majority of Canadians (52%) had a favourable opinion of mining. Only 15% were unfavourable. The remainder (29%) had not made up their mind. Quebec showed the smallest approval rating at 45%, while Atlantic Canada showed the largest, at 59%. Other results: BC (54%), the Prairies (54%) and Ontario (55%).

The 1994 New Brunswick survey to some extent compared New Brunswickers' responses to those of Canadians as a whole as revealed by the CRA survey of a year earlier. The following differences were noted in the opinions of those living in the province as compared with Canadians generally:

- somewhat more likely to emphasize the economic importance of the resource sector;
- more likely to see the mining industry as high-tech;
- less likely to attribute significant environmental damage to resource industries, including mining;
- slightly more likely to find resource sectors' environmental impacts acceptable, **except** in respect to mining;
- less likely to feel that mining activities disrupt other land uses.

Other surveys such as the CRA studies did not give a consistent breakdown of regional attitudinal differences, but rather mentioned significant geographic variations in the responses to certain issues. These indications are generally consistent with the regional trends identified by Angus Reid and Decima.

Comment

Compared with other Canadians, those living in the Atlantic provinces tend to be relatively easy-going with respect to their opinions about mining. While discriminating among issues in their approval of the mining industry, they recognize the economic contribution of the industry. On limited evidence, New Brunswickers appear to share this characteristic mindset.

Economic contribution of mining, present and future

It appears from the following evidence that Canadians appreciate the economic contribution of mining. It is also important to assess whether they feel that this contribution will be maintained at the same level, or whether they consider this to be a "sunset industry." For example, in the 1989 Angus Reid study, the most frequently mentioned strengths of the industry all related to economic contribution and job creation. Canada's and New Brunswick's perceived reliance on the resource sector is also demonstrated by later surveys.

The 1993 and 1997 national studies carried out by Corporate Research Associates (CRA) asked respondents to name (unprompted) Canada's most important industry. In both years, forestry/lumber/pulp & paper ranked first (31% and 23% respectively), followed by agriculture (21% and 17%), manufacturing (15% and 12%) and mining (13% and 11%). All these industries ranked above automotive (8% and 8%), fisheries (7% and 4%) and oil & gas (7% and 9%).

These two surveys also asked for ratings of the contribution of three broad sectors (resources, manufacturing and service sectors) to the Canadian economy, to the respondent's province and to his/her community. In 1997, some 69% of respondents said the resource sector was very important to the Canadian economy, as compared to manufacturing (56%) and services (56%). In relation to their province's economy, 77% of respondents on the Prairies and 76% in BC said that resources were very important, as compared with 56% in Atlantic Canada, 53% in Quebec and only 20% in Ontario. All regions ranked resources far above manufacturing and services except for Ontario, which put Manufacturing at 49%, services at 27%. At the community level, residents of communities under 10,000 population rated resources as the most important sector, whereas in communities of 10,000 to 100,000 the three sectors were ranked similarly. In communities over 100,000 services ranked first at 53%, while resources and manufacturing were tied at 21%.

The 1994 CRA New Brunswick study identified the natural resource industries' pre-eminence in the mind of respondents regarding the provincial economy. Again, forestry had a commanding lead (54%), followed in order by fisheries (15%), mining (12%), agriculture (11%) and manufacturing (11%).

Some surveys attempted to determine whether Canadians viewed mining as an industry of the future. In particular, the 1993 and 1997 CRA national surveys dealt with this question at some length. In the 1997 survey, 94% of respondents expected the telecommunications industry to grow, ahead of hydro power (84%), manufacturing (73%), oil& gas (70%), and agriculture (70%). Less likely to grow were forestry (56%) and mining (52%). However, the figure for mining was substantially ahead of the earlier survey (43%), indicating a certain growth of optimism since 1993.

The 1994 New Brunswick CRA survey results were similar to those of the 1993 national survey, with 95% expecting growth in telecommunications as compared with agriculture (67%), forestry (61%), mining (49%) and the fishery (39%). Those living in mining areas were much more likely to foresee a growth in mining activity.

The 1995 opinion-leader poll carried out by Compas found similar results to the above with respect to the economic prospects of the computer/telecom sector (92% expect better prospects in the next 10 years). However, only one-quarter of the respondents expect mining and forestry to enjoy better prospects, while over one-third expect poorer prospects for these industries. The only sector to receive a lower growth rating was auto manufacturing. Views of respondents had not changed substantially since an earlier poll in 1989. The relative pessimism on the part of opinion leaders is of concern.

Comment

Canadians are generally cognizant of the economic contribution of mining, though it is somewhat undervalued in comparison to other resource industries, notably forestry. The resource industries' contribution, including that of mining, to the provincial economy is well appreciated in resource-dependent regions, and even more keenly in rural communities.

Opinions are mixed regarding the future growth prospects for mining. These are consistently rated lower than for other resource sectors such as agriculture and oil & gas, but above fisheries. Even so, around half of the Canadians polled in 1997 projected better prospects for mining. While lower than for other sectors, this result represents a substantial improvement since 1993. Opinion leaders are not so sanguine: only around 25% project better times for mining, as compared with 43% for oil & gas.

Credibility of the mining industry in Canada

The believability or credibility of the mining industry is an important factor in determining its future prospects. If an industry is working for a more constructive policy climate, its credibility is a vital consideration. In communicating with opinion leaders and the public, the industry must present credible messages through believable spokespersons. Who are these credible spokespersons? Several of the industry-sponsored surveys have been designed to illuminate this question.

The 1989 Angus Reid survey asked respondents how credible they found several groups when making statements about the mining industry. The only group which a majority of Canadians (60%) said they would tend to trust (scoring 6 or more on a ten-point scale) were environmental groups. Fewer than half would trust any other group. Second to environmental groups were the news media (48%), followed by union leaders (47%) and industry associations (44%). Next came provincial (40%) and federal (35%) governments, with mining industry executives in last spot (34%). Mining communities agreed that environmentalists were most credible, followed by industry associations (53%) and union leaders (49%). The non-committed group's views reflect those of the general population. The pro-industry segment gives higher believability ratings to all groups. For a majority of the Antagonists, only environmentalists, the media and union leaders are credible.

In 1993, Decima asked Canadians who would be the most believable spokespersons on mining industry issues. The results vary substantially from those of the earlier Reid study. Such startling differences may be due more to methodological differences than to a shift in opinion. (Decima used a 7-point scale and required a score of 6 or more to count as believable: all scores between 3 and 5 inclusive were designated "depends on the issue"). In the Decima study, some 53% of Canadians rated mining professionals as believable (5% not believable, for a net score of +49). Next came mine workers (51, 5, +46), mining town community leaders (32, 7, +25), environmental

groups (26, 15, +11), mining association spokesperson (24, 17, +9), Native groups (24, 17, +7), news media (16, 18, -2), mining company executive (17, 24, -7), union leaders (17, 25, -8), and government officials (9, 34, -25).

Compas in both 1989 and 1995 asked opinion leaders to rate the believability of individual industries or institutions. Universities rated highest in both surveys (69% in 1995, 75% in 1989, for a loss of 6%), followed by the computer/telecom industry (56, 36, +20), banks (42, 31, +11), auto manufacturers (41, 28, +13), oil & gas (42, no 1989 data), mining (40, 26, +14), forestry (39, 25, +14), and federal government (29, 22, +7). While all sectors except universities are more highly rated than in 1989, the earlier ranking is maintained. In 1995, the mining industry is still rated very similarly to banks, autos, oil & gas, and forestry. Only computers/telecom has spurted well ahead of the other sectors. The generally higher ratings assigned to industry sectors in the later survey may reflect methodological or sampling differences. A more pro-business attitude following the 1994-95 recession may also be in play.

Comment

Available surveys differ in the believability rankings given by Canadians to various interest groups when discussing mining issues. Those who appear to be independent (universities, environmental groups, mining professionals) have fair to good credibility. Mining industry executives and government officials (particularly federal) rate fairly low. These factors must be taken into account in assigning spokespersons to carry messages to the public.

Environmental performance

A consistent finding of all the surveys is that Canadians have a deep-seated concern about the environmental impact of the mining industry. This is a frequently-cited criticism, whether in top-of-mind surveys or in directed interviews.

In the Reid survey of 1989, respondents were asked (before mining was mentioned) what they felt was the most important issue facing Canada. The most frequent response (at 26%) was "the environment." The impact of mining on the environment is relatively more important to younger people and to those with a higher level of education. Some 67 percent of Canadians were ready

to agree strongly or moderately with the statement that mining is a major source of pollution, whereas only 54% agreed that the industry's environmental record has improved in recent years.

The 1993 CRA study reported results that agreed closely with Reid, in that 68% of respondents felt that mining causes moderate or significant damage to the environment. This figure is somewhat less than those of other resource industries such as forestry (77%), oil & gas (76%), and coal (77%), but above hydro (59%). Differences among industries are more marked if only significant damage is compared, though the relative rankings are essentially unchanged. In the case, of significant environmental damage, mining (28%) trails forestry (43%), oil & gas (36%), and coal (33%) but remains ahead of hydro (21%). In 1997, CRA reported only the results for significant environmental damage, with almost identical results to 1993, although mining had a slightly lower score, at 25%.

It appears from the above data that Canadians' opinions about the significance of the mining industry's environmental impact has changed little in the past decade.

Acceptability of environmental impacts, given economic benefits

The CRA surveys also investigated to what extent Canadians regarded the resource industries' environmental impact as acceptable, given their economic benefits. In 1993, a narrow majority found mining industry impacts fully or somewhat acceptable (50%, compared to 47% unacceptable). By 1997 the proportion finding these impacts fully or somewhat acceptable had increased slightly, to 52%. In both years, mining rated below hydro, but above oil & gas, forestry and coal. Interestingly, Canadians 55 and older had become significantly less accepting in the four years since the first survey. While men and those with less education remain more accepting of environmental damage, in no demographic group did as many as 10% of respondents find environmental impacts fully acceptable.

Commitment to reducing environmental damage

How committed are resource industries to reducing environmental damage? The 1993 Decima survey found that 58% of respondents felt the mining industry was doing too little for the environment, as compared with 33% for "the right amount" and 4% "too much."

In 1997, CRA found that Canadians were slightly more ready to believe that industries were very or somewhat committed to reducing impacts than in 1993. While 54% found mining so committed in 1993, that figure had risen to 57% in 1997. Even then, mining rated lower than hydro (71%), forestry (65%), and oil & gas (61%), but above coal (48%).

The 1995 Compas survey asked opinion leaders to name the single industry sector which had made the most progress in improving environmental practices. The largest proportion (35%) mentioned mining, with forestry close behind (34%) and oil & gas trailing (8%).

Will improving the environment reduce competitiveness and cost jobs?

Canadians are not willing to accept environmental/economic tradeoffs, nor to believe that reducing environmental damage will make industry less competitive. The two CRA surveys showed a substantial margin of those who believe that reducing impacts will make resource industries **more** competitive over those who believe the reverse (45% to 17% in 1993, 49% to 16% in 1997). By an even wider margin, Canadians believed that reducing environmental impacts will provide more jobs, rather than decreasing employment.

Over time, opinion leaders have come largely to share this perception. In the 1989 Compas survey, only 16% felt that better environmental protection would boost the economy, while 27% said it would slow down the economy and 57% expected no real change in the economy. By 1995, 44% voted for boosting the economy, 27% for slowing it down, and 25% for no change.

These "no-tradeoff" findings are consistent with those of many other polls done over the last few years, quite unrelated to mining or the resource industries.

Land use issues

A related issue is the compatibility of mining with other land uses. There is a close relationship between the perceived environmental impact of mining and its acceptability in relation to other land uses. For example, the CRA surveys asked respondents to what extent they thought mining would disrupt other near-by land uses. In 1997, 45% (vs 50% in 1993) expected major disruption to wildlife and fish habitat, while only 19% (19% in 1993) felt its impacts would be minor or negligible.

Some 26% (31% in 1993) believed that mining would cause major disruption of forestry and lumber operations, and 19% (32% in 1993) felt that mining would create major problems with tourism and recreation activities. New Brunswickers were somewhat less inclined to attribute major disruptions to mining: wildlife and fish habitat (38%), forestry (38%), tourism and recreation (19%).

In an effort to probe the perceived tradeoffs between mining and parks, Decima (1993) found that Canadians are reasonably satisfied with the amount of land currently designated as parks (45% view it as sufficient). Nevertheless a substantial proportion of respondents would like to see more parkland (40%), while only 14% feel there is too much at present.

In the 1995 Compas opinion-leader survey, only about one-quarter of respondents spontaneously mentioned land use (24%) or biodiversity (28%) as the most important Canadian environmental issue in relation to resource industries (mining, logging and oil & gas). By contrast, water quality was mentioned by 78% and air quality by 66%. Nevertheless, when asked whether a new resource development should not proceed if it interfered with particular land uses, the responses were much stronger. Some 61% of respondents would abandon a project that interfered with wildlife, 50% if it required a road through a national park, 43% if it impaired the appearance of the landscape, 36% if the project occupied the area of a farm in an agricultural area, and 31% if it limited opportunities for sports fishing. The 1995 responses were consistently less accepting of these impacts than the 1989 responses.

Comment

Canadians have a deep-seated concern about the environmental impact of the mining industry. It is the most frequently-cited weakness of mining. Canadians are equally divided on whether or not the environmental impact of mining is acceptable, given the industry's economic contribution. Slightly over half of Canadians believe that the industry is committed to environmental improvement, though opinion leaders single out mining as the industry with the highest degree of commitment, slightly above forestry. Canadians do not believe that improved environmental protection will harm competitiveness or cost jobs: in fact the majority believe the reverse. Environmental concerns extend to land use. Half of Canadians would expect mining activity to cause major disruption to wildlife and fish habitat, and a majority would advocate abandoning a mining project that did interfere with wildlife.

Technology, production methods, and worker safety

The issues of worksite safety and mining industry production technology are inevitably linked in the public mind. To what extent is mining perceived as a dangerous industry, its workers exposed to unpleasant workplaces and using antiquated technology?

Angus Reid (1989) probed several aspects of the mining industry's perceived performance in relation to production methods, safety and technology. As noted earlier, when asked to state a top-of-mind weakness of the mining industry, 10% of Canadians mentioned "poor worker safety", but this concern appeared only half as often as "harms the environment." Over half (60%) of Canadians approved of the industry's performance in developing new methods and technologies to make Canada more competitive. Except for residents of mining communities, however, they believed that forestry is outperforming mining in the development of new technologies. With respect to worker safety, 53% of Canadians, and 63% of residents in mining communities, felt that the Canadian mining safety record is superior to that of other countries. As well, a majority of Canadians (52%, 68% in mining communities) believed that improving the health and safety conditions of mine workers is a priority with the mining industry (as a priority, it fell behind "competing in the market" and "discovering new deposits", but ahead of "raising capital", "protecting the environment", and "finding workers").

In the 1993 survey, Decima found that a majority of Canadians (54%) agreed with the statement, "the Canadian mining industry is a leading sector in the research and development of new technology." Only 18% disagreed. Approval is not so clear-cut in the matter of safety. Some 38% rated the industry's record on worker safety as good or very good, as compared with 27 % poor or very poor. A similar split was prompted by the statement, "the Canadian mining industry is a leading sector when it comes to safety and protecting workers." 44% agreed while 36% disagreed. In direct comparison with other sectors, however, mining does not emerge as a winner. For example 46% said the transportation industry is "somewhat better" or "a lot better", as compared with 11% "worse." Comparable results were found for other sectors: manufacturing (44% vs 11%), construction (40% vs 14%), agriculture (36% vs 17%) and forestry (34% vs 11%). Only in the case of forestry are as many as 50% of Canadians ready to say that the safety record of the

two industries is about the same. Atlantic Canada residents are more likely than other Canadians to say that other sectors are better than mining.

The 1997 CRA study found that 69% of Canadians agreed with the statement that "the Canadian mining industry uses the latest high-technology products and services to do its job."

Along the same lines, the 1995 Compas survey asked opinion leaders to name the single Canadian sector which was a world leader in specialized technology in its field. While (not surprisingly) the computer/telecommunications industry ranked first with 58% of mentions, mining was a robust second at 18%, followed at a distance by forestry (7%), oil & gas (7%) banks (3%) and autos (2%). Compas also asked for the one industry sector which had made the most strides in emphasizing employee safety and training. Mining was the clear winner (28%), with autos behind (18%) followed by forestry (13%) and oil & gas (6%).

Comment

Contrary to expectations, mining is consistently rated as a leader in the development and use of new technology by a majority of Canadians, including opinion leaders. Similarly, while Canadians are concerned about mining workers' health and safety, the industry is given credit for working to protect them. By a small margin, more Canadians find the industry's safety record "good or very good" than "poor or very poor", though mining is rated behind other industries such as manufacturing and construction. A majority of Canadians accept that protecting workers is an industry priority, and opinion leaders single out mining as the industry that has made the most strides in emphasizing employee training and safety.

This concludes the description of the findings of public perception surveys on mining in Canada. For the public policy implications of these findings, and the recommendations that flow from them, see Chapter 7, Section 7.1.

Appendix C: Exploration-Price Relationship

Part 1. Metal prices: charts and data

Figure C-1(a): Copper Prices
LME Annual Average: Current Dollars

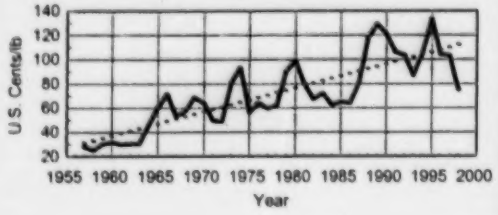


Figure C-1(b): Copper Prices
LME Annual Avge: Constant 1998 Dollars

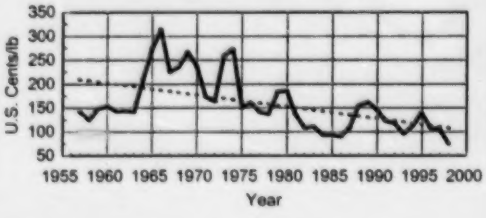


Figure C-2(a): Gold Prices
LME Annual Average: Current Dollars

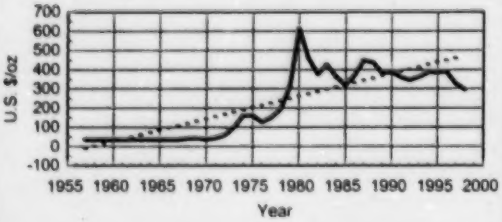


Figure C-2(b): Gold Prices
LME Annual Avge: Constant 1998 Dollars

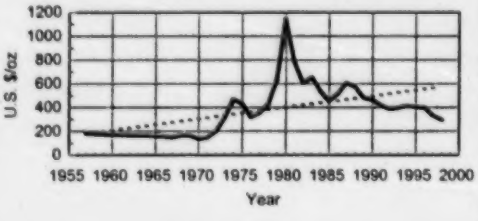


Figure C-3(a): Lead Prices
LME Annual Average: Current Dollars

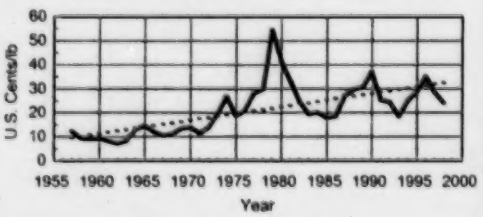
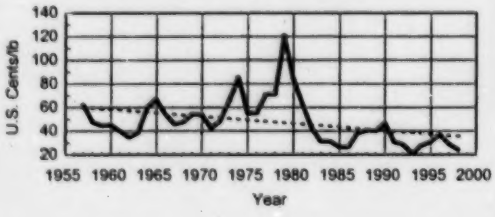


Figure C-3(b): Lead Prices
LME Annual Avge: Constant 1998 Dollars



Appendix C, Part 1 (Continued)

Figure C-4(a): Silver Prices
LME Annual Average: Current Dollars

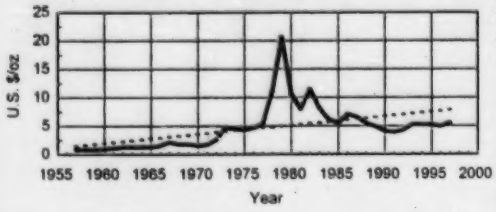


Figure C-4(b): Silver Prices
LME Annual Avge: Constant 1998 Dollars

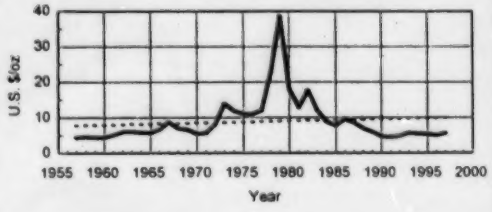


Figure C-5(a): Zinc Prices
LME Annual Average: Current Dollars

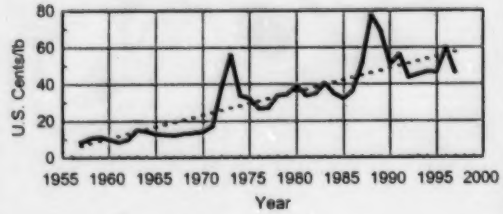


Figure C-5(b): Zinc Prices
LME Annual Avge: Constant 1998 Dollars

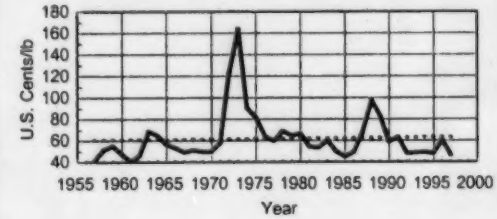


Figure C-6(a): Potash Prices
FOB Vancouver, Current Dollars

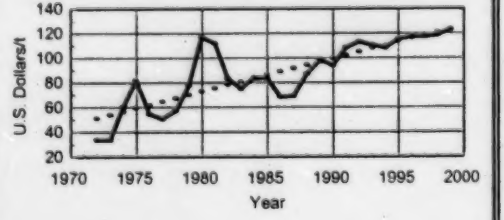
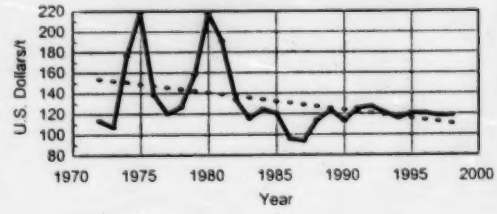


Figure C-6(b): Potash Prices
FOB Vancouver, Constant 1998 Dollars



Appendix C, Part 1 (Continued)

Table C-1: Annual Average Mineral Commodity Prices, 1957-98
(Current US Dollars)

Year	Copper (Cents/lb.)	Lead (Cents/lb.)	Zinc (Cents/lb.)	Silver ($/oz.)	Gold ($/oz.)	Potash ($/t)
1957	27.9	12.2	10.3	0.91	35.00	N/A
1958	25.1	9.3	8.4	0.89	35.00	N/A
1959	30.2	9.0	10.5	0.91	35.00	N/A
1960	31.8	9.2	11.4	0.91	35.00	N/A
1961	29.7	8.2	9.9	0.92	35.00	N/A
1962	30.3	7.2	8.6	1.08	35.00	N/A
1963	30.2	8.1	9.8	1.28	35.00	N/A
1964	45.4	12.8	14.9	1.29	35.00	N/A
1965	60.6	14.6	14.3	1.29	35.00	N/A
1966	71.4	12.1	12.9	1.29	35.00	N/A
1967	52.9	10.4	12.5	1.55	35.00	N/A
1968	57.8	11.1	12.1	2.14	40.06	N/A
1969	68.4	13.3	13.1	1.79	41.51	N/A
1970	63.9	13.8	13.4	1.77	36.41	N/A
1971	49.3	11.5	14.1	1.55	41.25	N/A
1972	48.6	13.7	17.1	1.68	58.44	33.58
1973	80.9	19.5	38.5	2.56	97.58	33.58
1974	93.1	26.8	56.0	4.71	159.62	60.29
1975	56.1	18.7	33.8	4.42	161.17	81.67
1976	64.1	20.5	32.3	4.35	124.94	54.58
1977	59.4	28.0	26.8	4.62	147.98	50.54
1978	61.9	29.9	26.9	5.40	193.44	57.13
1979	89.9	54.5	33.7	11.09	307.62	77.38
1980	99.4	41.2	34.5	20.63	612.51	116.54
1981	79.5	33.3	38.9	10.52	459.61	111.79
1982	67.1	24.7	33.7	7.95	376.01	83.17
1983	72.1	19.3	34.7	11.44	423.83	74.88
1984	62.5	20.1	40.5	8.14	360.29	83.71
1985	64.9	17.8	34.9	6.14	317.30	83.75
1986	64.2	18.4	32.1	5.47	367.87	68.38
1987	80.3	27.0	36.2	7.01	446.41	69.04
1988	118.0	29.7	51.1	6.53	436.93	86.67
1989	129.0	30.6	77.6	5.50	381.28	98.21
1990	121.1	37.0	68.8	4.87	384.08	93.92
1991	106.2	25.3	50.7	4.04	362.04	108.25
1992	103.7	24.5	56.2	3.94	343.74	112.92
1993	86.8	18.4	43.6	4.30	359.77	110.21
1994	104.9	24.9	45.3	5.29	384.15	107.83
1995	133.2	28.6	46.8	5.20	384.07	115.00
1996	103.9	35.1	46.5	5.20	387.69	117.00
1997	103.3	28.3	59.8	4.90	328.41	117.00
1998	75.0	24.0	46.4	5.54	294.11	118.50

Source: Natural Resources Canada
Metal prices: LME or equivalent. Potash price: FOB Vancouver

Appendix C, Part 1 (Continued)

Table C-2: Annual Average Mineral Commodity Prices, 1957-98
(Constant 1998 US Dollars)

Year	Price Index**	Copper (Cents/lb.)	Lead (Cents/lb.)	Zinc (Cents/lb.)	Silver ($/oz.)	Gold ($/oz.)	Potash ($/t)
1957	19.68	141.8	62.0	52.3	4.62	177.82	N/A
1958	20.15	124.5	47.3	41.7	4.42	173.66	N/A
1959	20.37	148.3	44.7	51.6	4.47	171.86	N/A
1960	20.65	154.0	45.2	55.2	4.41	169.50	N/A
1961	20.89	142.2	39.7	47.4	4.40	167.55	N/A
1962	21.16	143.2	34.5	40.7	5.11	165.44	N/A
1963	21.40	141.1	38.3	45.8	5.98	163.52	N/A
1964	21.72	209.0	59.8	68.6	5.94	161.12	N/A
1965	22.15	273.6	67.2	64.6	5.82	158.02	N/A
1966	22.78	313.4	54.6	56.6	5.66	153.65	N/A
1967	23.51	225.0	45.7	53.2	6.59	148.89	N/A
1968	24.53	235.7	47.2	49.3	8.72	163.33	N/A
1969	25.68	266.3	54.2	51.0	6.97	161.64	N/A
1970	27.05	236.2	53.7	49.5	6.54	134.61	N/A
1971	28.45	173.3	42.5	49.6	5.45	144.99	N/A
1972	29.66	163.9	48.2	57.7	5.66	197.06	113.24
1973	31.32	258.3	65.8	122.9	8.17	311.51	107.21
1974	34.14	272.7	85.6	164.0	13.80	467.57	176.61
1975	37.35	150.2	54.8	90.5	11.83	431.51	218.65
1976	39.53	162.1	54.9	81.7	11.00	316.04	138.07
1977	42.09	141.1	70.8	63.7	10.98	351.59	120.08
1978	45.16	137.1	71.0	59.6	11.96	428.35	126.50
1979	49.01	183.4	120.7	68.8	22.63	627.66	157.87
1980	53.54	185.7	84.1	64.4	38.53	1,144.10	217.69
1981	58.58	135.7	62.2	66.4	17.96	784.63	190.85
1982	62.27	107.8	42.2	54.1	12.77	603.86	133.56
1983	64.92	111.1	31.0	53.4	17.62	652.83	115.33
1984	67.37	92.8	31.0	60.1	12.08	534.79	124.25
1985	69.69	93.1	26.4	50.1	8.81	455.32	120.18
1986	71.51	89.8	26.4	44.9	7.65	514.46	95.62
1987	73.71	108.9	37.8	49.1	9.51	605.66	93.67
1988	76.40	154.5	40.3	66.9	8.55	571.93	113.44
1989	79.62	162.0	40.1	97.5	6.91	478.89	123.35
1990	83.06	145.8	46.5	82.8	5.86	462.41	113.07
1991	86.36	123.0	30.5	58.7	4.68	419.22	125.35
1992	88.74	116.9	28.4	63.3	4.44	387.36	127.25
1993	91.08	95.3	20.7	47.9	4.72	395.00	121.00
1994	93.26	112.5	27.3	48.6	5.67	411.93	115.63
1995	95.40	139.6	30.7	49.1	5.45	402.58	120.54
1996	97.20	106.9	36.8	47.8	5.35	398.88	120.38
1997	99.01	104.3	29.1	60.4	4.95	331.71	118.17
1998	100.00	75.0	24.2	46.4	5.54	294.11	118.50

Price figures are derived from data in Table 1 by application of the price index.
**Price index used is the U.S. GDP Implicit Price Index.
Source: Natural Resources Canada

Appendix C: Exploration-Price Relationship

Part 2. Mineral Exploration Charts and Data

Figure C-7: Exploration Expenditures

Excl Overhead, Current Dollars

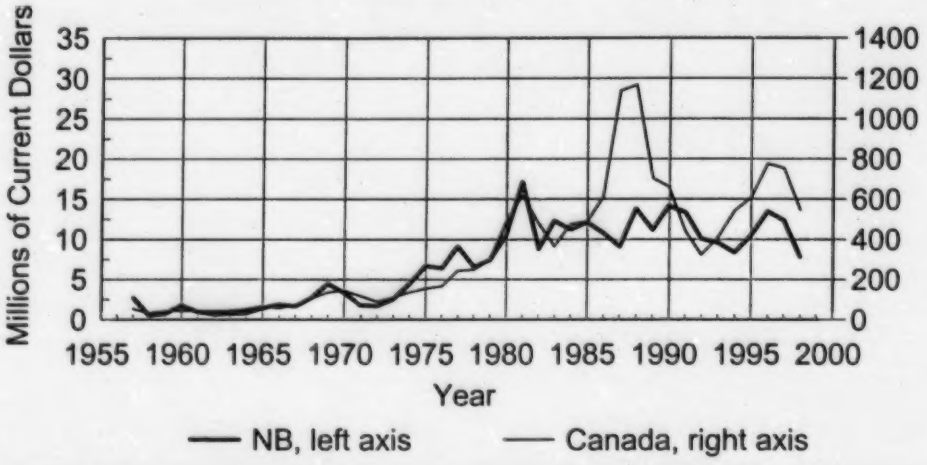
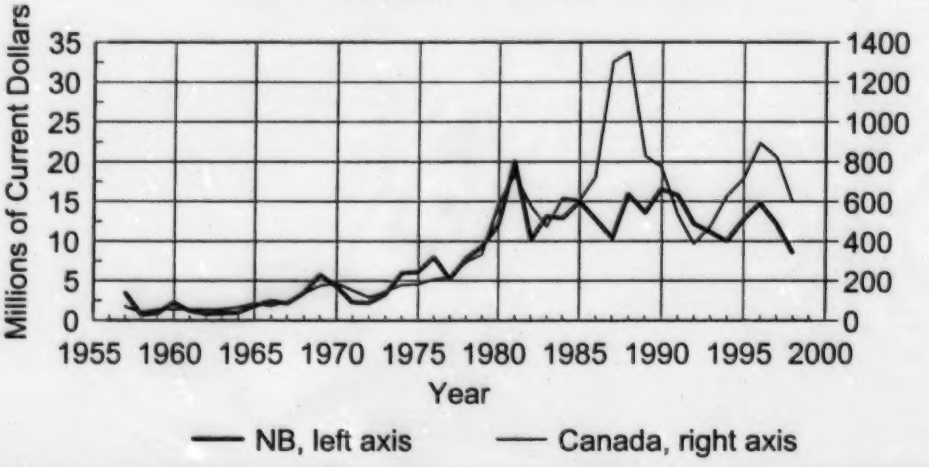


Figure C-8: Exploration Expenditures

Incl Overhead, Current Dollars



Appendix C, Part 2: (Continued)

Figure C-9: Exploration Expenditures

Excl Overhead, Constant 1998 Dollars

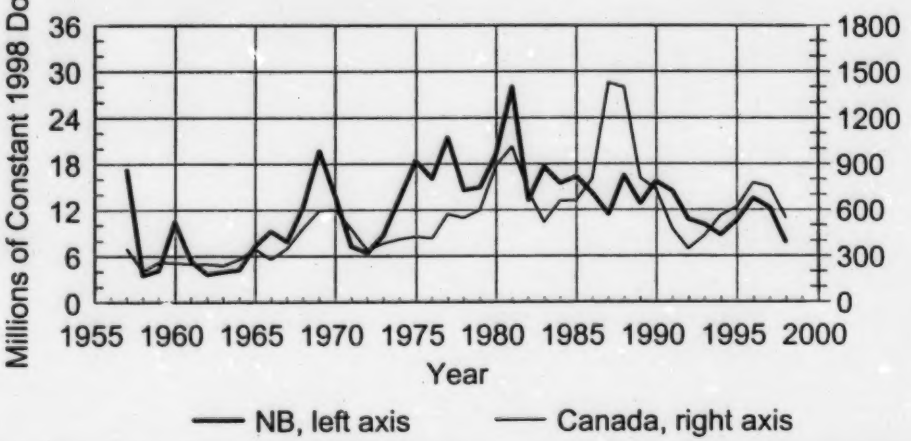


Figure C-10: Exploration Expenditures

Incl Overhead, Constant 1998 Dollars

Appendix C, Part 2: (Continued)

Table C-3: Exploration Expenditures, Excluding Overhead Expenses, 1957-1999
(General plus Minesite, Million Canadian dollars)

	Current Dollars		Price Index**	Constant 1998 Dollars	
Year	N.B.	Canada		N.B.	Canada
1957	2.69	54.42	15.62	17.22	348.38
1958	0.56	32.51	16.06	3.49	202.39
1959	0.69	43.02	16.50	4.16	260.69
1960	1.78	43.55	16.94	10.48	257.09
1961	0.94	43.49	17.49	5.35	248.59
1962	0.65	43.79	17.77	3.63	246.38
1963	0.72	43.50	18.15	3.98	239.68
1964	0.79	52.00	18.62	4.22	279.34
1965	1.41	66.60	19.27	7.32	345.61
1966	1.87	56.50	20.30	9.23	278.33
1967	1.67	74.00	21.14	7.90	350.03
1968	2.70	105.50	21.98	12.28	479.91
1969	4.50	136.70	22.92	19.63	596.46
1970	3.30	144.50	24.04	13.73	601.05
1971	1.80	118.50	24.88	7.23	476.23
1972	1.70	89.10	26.38	6.44	337.76
1973	2.50	110.30	28.81	8.68	382.83
1974	4.50	136.00	33.12	13.59	410.69
1975	6.70	154.80	36.48	18.36	424.31
1976	6.40	166.50	39.85	16.06	417.81
1977	9.10	243.80	42.56	21.38	572.80
1978	6.60	249.00	45.37	14.55	548.83
1979	7.40	298.10	49.67	14.90	600.13
1980	10.60	489.00	55.10	19.24	887.51
1981	17.10	619.20	61.18	27.95	1,012.12
1982	8.80	478.00	66.42	13.25	719.69
1983	12.30	364.80	69.97	17.58	521.35
1984	11.20	476.00	72.31	15.49	658.27
1985	12.10	490.50	74.09	16.33	662.05
1986	10.80	611.40	76.15	14.18	802.93
1987	9.10	1138.60	79.79	11.40	1,426.92
1988	13.77	1167.26	83.44	16.50	1,398.88
1989	11.19	703.49	87.28	12.82	806.04
1990	14.13	660.28	89.90	15.72	734.49
1991	13.36	439.24	92.33	14.47	475.73
1992	10.10	323.46	93.55	10.79	345.77
1993	9.55	410.13	94.95	10.06	431.95
1994	8.37	540.49	95.98	8.72	563.14
1995	10.49	608.13	98.32	10.67	618.54
1996	13.45	776.91	99.81	13.48	778.37
1997	12.34	753.40	100.47	12.28	749.89
1998	7.82	547.72	100.00	7.82	547.72

**Canada GDP Implicit Price Index, 1998=100 (adjusted for missing values 1957-60)

Appendix C, Part 2: (Continued)

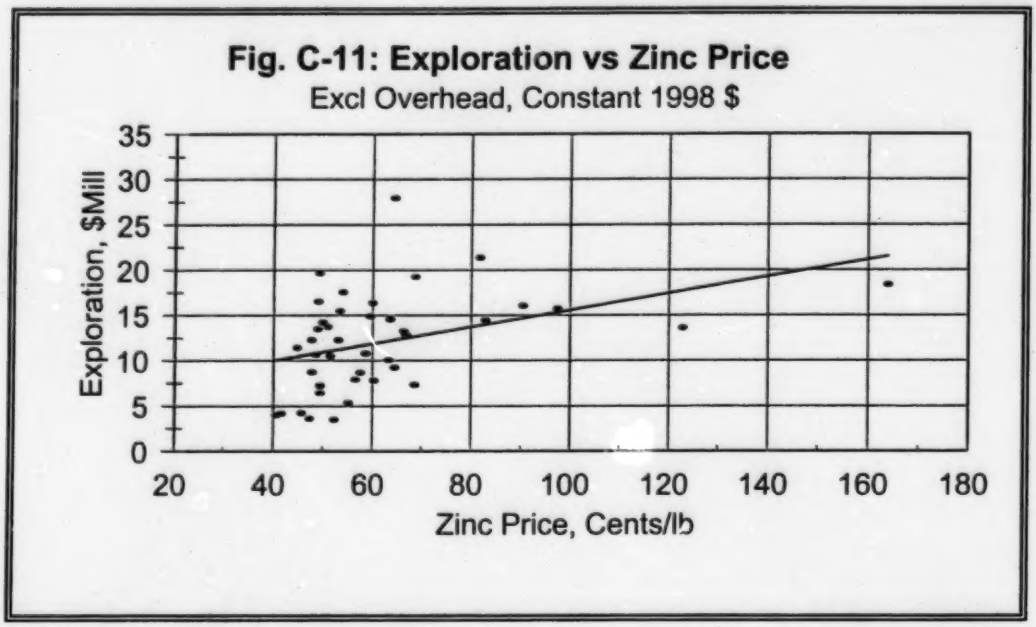
Table C-4: Exploration Expenditures, Including Overhead Expenses, 1957-1999
(General plus Minesite, Million Canadian dollars)

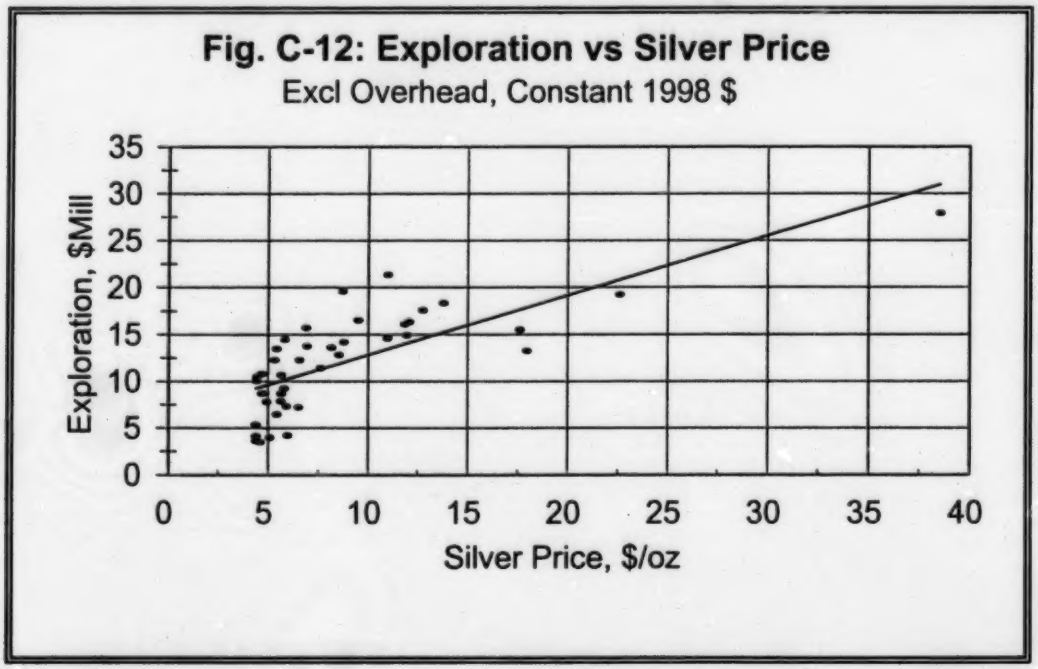
	Current Dollars		Price	Constant 1998 Dollars	
Year	N.B.	Canada	Index**	N.B.	Canada
1957	3.44	69.66	15.62	22.04	445.92
1958	0.72	41.61	16.06	4.47	259.06
1959	0.88	55.06	16.50	5.32	333.69
1960	2.27	55.75	16.94	13.41	329.08
1961	1.20	55.66	17.49	6.84	318.19
1962	0.83	56.05	17.77	4.65	315.36
1963	0.92	55.67	18.15	5.09	306.79
1964	1.00	66.56	18.62	5.40	357.55
1965	1.80	85.25	19.27	9.37	442.38
1966	2.40	72.32	20.30	11.81	356.27
1967	2.14	94.60	21.14	10.11	447.46
1968	3.45	135.00	21.98	15.72	614.11
1969	5.76	174.90	22.92	25.12	763.14
1970	4.27	187.10	24.04	17.77	778.25
1971	2.31	152.00	24.88	9.28	610.86
1972	2.21	115.70	26.38	8.37	438.59
1973	3.27	144.10	28.81	11.34	500.14
1974	5.97	180.30	33.12	18.02	544.47
1975	6.10	182.70	36.48	16.72	500.79
1976	7.95	206.80	39.85	19.95	518.94
1977	5.20	220.00	42.56	12.22	516.88
1978	7.81	294.92	45.37	17.22	650.04
1979	9.30	333.40	49.67	18.72	671.20
1980	12.20	590.70	55.10	22.14	1,072.09
1981	20.00	734.20	61.18	32.69	1,200.09
1982	10.20	576.30	66.42	15.36	867.70
1983	13.10	471.80	69.97	18.72	674.27
1984	12.90	617.30	72.31	17.84	853.68
1985	14.94	605.80	74.09	20.17	817.68
1986	12.78	723.29	76.15	16.78	949.87
1987	10.39	1300.00	79.79	13.02	1,629.19
1988	15.93	1350.00	83.44	19.09	1,617.88
1989	13.59	827.93	87.28	15.57	948.61
1990	16.51	774.72	89.90	18.37	861.79
1991	15.81	531.76	92.33	17.12	575.94
1992	12.21	385.33	93.55	13.05	411.92
1993	11.09	477.25	94.95	11.68	502.64
1994	10.02	628.13	95.98	10.44	654.46
1995	12.72	717.60	98.32	12.93	729.88
1996	14.80	894.80	99.81	14.83	896.48
1997	12.16	820.18	100.47	12.11	816.36
1998	8.61	601.14	100.00	8.61	601.14

**Canada GDP Implicit Price Index, 1998=100 (adjusted for missing values 1957-60)

Appendix C: Exploration-Price Relationship

Part 3. Sample Correlations of New Brunswick Exploration Expenditures (Lagged 1 year) with Metal Prices





Appendix D: Comments and Suggestions Received

This Appendix records the very voluminous comments and suggestions received during the course of this study from a large number of individuals who are knowledgeable about the issues and/or familiar with New Brunswick's resource base. This material was extracted from numerous interviews as well as from written communications sent to us in response to a questionnaire. In all, over 90 individuals have been involved in these consultations. Respondents were drawn from a wide range of private-sector organizations (from prospectors and junior companies through major corporations), from academia, and from government (New Brunswick, other provinces and territories, and federal).

Each collection of comments is relevant to a particular section of the body of the Report and is referenced accordingly. The authors have not evaluated the accuracy of these comments, nor are we in a position to give them any blanket endorsement. They are provided here, either in their original form, or lightly paraphrased, with the understanding that the government may find it useful to study them. In some cases, the comments will provide useful insights into the reasons for our recommendations. In others, where the comments may be based on a misunderstanding of the government's policies or programs, they may show the need for better 2-way communication.

3.6.2 Perception of resource potential by those familiar with New Brunswick

Private sector

- I do not think that the future level of mine employment will again reach the levels that were seen in the past. It is becoming more difficult to find economic deposits because the easier ones have been found, the environmental costs are becoming costlier and productivity per man shift is becoming less. Recycling is also becoming big business..... I think that mining activity will be around 50% of its peak in NB.
- It will be very difficult (to return to the past employment level). Less than 50% (probability).
- Yes, possibly. 50-50 probability providing metal prices improve.
- I believe that other commercial mineral deposits remain to be discovered - not only in the Bathurst camp, but in other geological environments not identified and described in the province...DNRE (must have) individuals experienced and knowledgeable in geological

environments which contain world-class commercial mineral deposits...My only criticism regarding the present climate for mineral exploration in New Brunswick is the lack of emphasis on fieldwork which is relevant to economic geology.

- I suspect we have seen the 'glory days' for mining in N.B. until gradual changes in the world economy bring another group of metals or industrial materials into demand.
- No. 40% probability (of return to past employment level).
- I believe that there is a possibility that it could be close to that of the past.
- 20-30%, unless there is a substantial sustained exploration effort, then, perhaps 60-80%.
- 50%, if metal prices improve and $10-15 million is spent in the province annually, spread over a number of environments and spread among numerous companies.
- No (we will not see a return to past employment levels).
- Unlikely to see industry return to previous employment level.
- Yes, but an approach involving community or regional control should be put in place.....70%, if $15 million annual exploration expenditure.
- Yes, 50% probability, but needs discovery catalyst like Voisey's Bay in case of Newfoundland.
- Yes, but with a different focus. Look for a larger number of smaller mines and not just the bigger ones....75% probability with $10 million annual exploration spending.

Public sector

- Making estimates of the percentage probability of a rebound in production and employment is an exercise in speculation (or is this question merely intended to gauge perceptions?), and depends on many variables, including the magnitude of the 'sustained exploration effort' (mainly), continued strong support from federal and provincial surveys in provision of geoscience data and exploration assistance programs, metal prices, the stock market, possible metal 'dumping', geopolitical considerations, and so on.....A single discovery could potentially be made with very low expenditure, whereas a high exploration budget may be unsuccessful, depending on how it is spent and who is spending it.....An average annual expenditure of $10-15 million is probably enough to sustain a discovery rate. But how the money is targeted is important; if most were spent in gold exploration, we could probably predict, with some confidence, that a gold mine would be developed within a few years.
- With sustained effort it is certainly possible to return to former production capacity. There are several commodities in various geological environments that have received only cursory attention by the mining industry and government. ...High percentage probability (of return to

former employment levels).....Expenditures in a given area should be approaching those invested in the Bathurst camp both by government and private industry.

- Balanced annual expenditures of $15 million/year should enable economic deposit to be found during the next 5 to 10 years. The cost of finding an economic deposit in Canada is well over $150 million.....The probability of finding an economic gold deposit is very good (75%) .....Most of the (Bathurst base metal) deposits (90%) found to date are very close to the surface.....there is a good probability (50%) to find extensions to these deposits using modern geophysical and geochemical techniques.....the probability (75%) of finding nickel-cobalt mineralization similar to the Black Hawk deposit of Maine is very good.....the probability that industrial minerals will play a greater role in the future ..is very high (70%) ....in the order of $100,000 are required (annually) to stimulate exploration and related development in the industrial minerals sector.

3.7 Prospectors and small exploration companies (and MESP)

Private sector comments

- I have no experience with the MESP program, but it is very good for junior companies as prospectors provide the supply of prospects which juniors can use as the basis for selling shares to finance exploration and the NBEAP program complements the relatively small amounts which can be raised in the current market for exploration company shares. Yes, the MESP and NBEAP programs influence the decisions of companies to spend in NB. Freewest and Eastmain, for example, wouldn't be here without them. Offering prospecting courses throughout NB would be a key incentive, if the interest is there or can be aroused. More prospecting activity would benefit the province, absolutely.
- The MESP procedures and rules are fine, but the program would be much more effective if the maximum grant were $5,000.
- Prospectors need the maximum assistance raised to $5,000, courses need to be reintroduced, more rudimentary equipment (beep mats, VLF units and magnetometers) needs to be available at DNRE for prospectors to borrow and chits for chemical analyses need to be provided.
- NB should do more to get local prospecting activity. This is where the long term committment to the province lies. There needs to be courses offered in communities. The internet could be used in making data accessible without people having to incur cost and time of driving to Fredericton, Bathurst or Sussex to get information on goverment geology, geochemical

surveys or other surveys and assessment data. DNRE should be more promotional, both in creating local prospecting interest and attracting outside investors. In the case of outside investors, they should make use of the drawing power of the Premier and try to arrange to get him to address international conventions like the Prospectors and Developers Association convention in Toronto which draws 6-8,000 people a year.

- The MESP ceiling should be increased to $10,000/ year. Prospectors need assays done. Perhaps the university can help? The Mines Branch in Bathurst has a plugger (portable drill) which can be borrowed. This should be more widely known and more such equipment should be available to borrow. The courses should be reintroduced and should include training on use of simple geophysical equipment and portable drills.
- The first year someone applies for a MESP grant, there should be a maximum grant of $5,000. If the person performs well and submits a report demonstrating responsible use of the money, the upper limit in subsequent years should be $10,000. There should be separate assaying support, either through a chit system or by having DNRE look after assaying samples brought in. The prospecting courses definitely must be reintroduced.
- More prospecting can only enhance the likelihood a new mine will be found. It would also serve to strengthen public support for the industry. Providing prospecting courses (where there is demand) provides a valuable opportunity for people to get involved. But only news of a major find would actually cause average people to flock to the woods in search of minerals.
- Prospector grants were excellent when I was working there.
- It is more important to assist prospectors than junior companies. MESP grants are too small at $1,500. Those who build and use logging and other roads should be encouraged to 'break rock' and bring in samples to DNRE. Prospecting courses and ongoing guidance (including sample assays for those who don't receive grants) for those who take up prospecting are highly recommended. MESP and all other mineral exploration incentive programs are poorly advertised.
- Increase the maximum for MESP grants to about $5,000. Provide assay chits or a limited number of assays for prospectors. Definitely very important to reintroduce the prospector courses given by private sector. The 3-day course plus a 1-day field trip is adequate to get people interested and started. This is analogous and just as important to maintaining a mineral industry as the DNRE-supported courses on 'sustainable forest management practices' are to maintaining a forest industry. In fact, a 'periodic half day, or so, mineral identification' course similar to the 'tree identification' course would be a good idea.

- My only criticism regarding the present climate for mineral exploration in New Brunswick is the lack of an emphasis on fieldwork which is relevant to economic geology. This must be corrected.
- Prospector ecotourism and industrial tourism should be promoted if the mining industry is to have a secure future and strong public support. NB needs a discovery to bring back the major mining investors. More flying and geochemistry surveys should be done in conjunction with prospecting courses taught by private contractors on how to use the information. There should be an annual or periodic prize or bonus or personal income tax exemption for anyone who makes a discovery that is totally new.
- MESP is good, but underfunded. However, there are not enough junior companies which can raise financing. Such companies are the usual "middle man" between the prospectors and senior companies. Senior companies are too conservative to take on most prospects until enough drilling has been done to eliminate much of the risk. Thus, there is also need, particularly at the present time, for a program like NBEAP and/or a NB-specific tax break for investors in such companies ." At present, DNRE is not proactive and sufficiently promotional to encourage prospecting. It should be proactive rather than reactive.
- NS gives grants of $5,000 to prospectors, but NB gives only $1,700. Only 1 prospector from the north and 1 from the south gets some government support to attend the Prospectors and Developers Conference in Toronto where there is some chance of meeting the mining people who could invest in their prospects. NS gives funding to almost every prospector who wants to attend the Conference. DNRE shouldn't go this far, but at least needs to support those who have prospects which have a chance of attracting interest.They also help these prospectors in preparing their promotion package.
- The prospecting course should be reintroduced at centres throughout the province . The teaching of it should be put up for bid. For the very minimum or most basic course, it is possible that $10,000 to $12,000 of government contribution would be enough to result in bids from capable people. This assumes a 3 day course for, say, 100 students/year and a cost per student of $250-300, including samples, materials and a tuition which definitely would have to be no more than $150 if the course is to attract enough students. More participation and a greater benefit to the province would result from a greater government contribution and less reliance on tuition. $50 was the maximum tuition that was charged in the past, so the $150 upper limit may be too high. In the past, participants asked for more advanced courses, but these could not be provided. There was always a waiting list.

- Initiation to geology courses should be given at the high school level to every student in this province. This would help to promote prospecting activities over the entire province. The CEGEP program in Quebec requires all science students to take a mandatory geology course.
- I have received MESP grants on two occasions.....for analyses of a number of prospects (of lesser known minerals) which I am currently promoting (to investors) in a quiet way. ... I would not have done these projects without the MESP grants as it was a lean period. I found the funding adequate (approx $700 each time), but I have heard from a number of prospectors that the maximum on MESP grants is distinctly too small and they would do more if they had more support for travel costs and analyses.
- The main reason for (my) working in NB was proximity (to prospecting localities), to keep costs low. Familiarity with information was the next most important consideration.
- There is a demand for introductory (hobby) prospecting courses, and I am surprised that DNRE has not responded to it (other than the well-presented advanced courses by David Lentz in Bathurst) whether by doing them with Department staff or contracting. After a news item appeared in the papers at the time of our last course, in Sussex, I had calls from at least 30 people, and forwarded the phone numbers to Fredericton, but no course has been organized...More prospectors would be a benefit. I am impressed that several of the existing ones manage to find something of interest just about every summer.
- The MESP grant upper limit probably should be increased to $5,000/yr. The prospectors course is definitely justified and necessary, if new people are to take up prospecting. The current group of prospectors are getting older and fewer in number. Few people have any awareness about prospecting or how mines are found and hence there aren't many people doing hobby or part time prospecting, even though it could be very interesting, healthy and sometimes financially rewarding .
- NB must have more prospectors that have training and are active if we are to sustain a mining industry. Courses for prospectors must be offered. This could be done on the old model of contracting out the teaching in order to reach those who aren't computer literate or equipped with a suitable computer. A new approach which would work very well, particularly with the younger people who are our next generation of prospectors, would be to make available an interactive course on the Internet. A kit of rock and mineral samples would be provided and would be complemented by a contracted 'hands on' field component, with exposure to use of equipment , technique, etc. The Internet is also an invaluable resource

that the province should be using not only to give this kind of interactive course, but to make available resource information to these new prospectors as well as prospective outside investors and geologists. It should be possible not only to file assessment reports via e-mail, but to access assessment files, claim maps, various types of survey data and commodity data on the DNRE web site.

- Yes, if there is still an interest in courses by the public.
- Yes, I have received MESP grants. It would be good to have full time prospectors but this is not possible if we do not have exploration activities by exploration firms.
- It would encourage New Brunswickers to take up hobby prospecting if DNRE offered free assays.
- Yes, I have received MESP grants three times, each time for a different prospecting area. The total was about $4,000 over 9 years. I probably would have done some of the prospecting without the grants, but certainly a lot less. Government and industry people should both do more to increase the profile and public image of the mining industry. If done correctly, that, in itself, would encourage interest in prospecting by the general public. Offering prospecting courses would then make it possible for people to productively fulfil the interest.
- The current grant-based incentive programs have been successful in attracting capital for certain projects. These programs, however, do not do much to generate public awareness of our industry. They also take a certain amount of administrative resources ...(and) ...do not generate much long term employment.
- 1) NB needs a discovery to generate more exploration. Efforts have to be made to lure mining companies to explore in NB.

  2) Many prospectors are active. NB has to help and encourage them as much as possible.

  3) More PR/communications should be done within mining community and with general public.
- The assistance given to prospectors in the past should be reviewed with respect to costs, results and purpose. If the results were fruitful, then consideration should be given to renewing and enlarging the program.
- Is the provincial geological program driven by the industry? What proportion of the program is self-serving? Who audits the output? How much of the program is practical geology and what amount is research? I remember the discovery of the potash deposits. Does the same

zeal exist? How many prospectors and/or juniors visited the geological offices in 1999 and each of the previous 5 years?

- And, finally, the following letter submitted by Rufus Smith on behalf of prospectors of the Bathurst area to the Honourable D. Tyler, Minister of Natural Resources and Energy in the previous government:

"We, the undersigned, would like to request that the MESP annual budget be increased from its current amount of $50,000 to a maximum value of $100,000. Our justification for this increase is as follows:

1) With the closure of the Noranda Exploration assay lab in Bathurst the costs of assaying and sample shipping have increased dramatically. For a comparable service, outside the province, transportation will require the use of courier of mail services instead of dropping them off. (Estimate cost of $17.00 to $30.00 per box of less than 50 lbs.)

2) The recent Protected Areas Strategy hearings have had a detrimental effect on the ability to raise funding for New Brunswick Exploration. Until the government makes a definitive statement as to what they area going to do, a large part of the province will be treated as "un-explorable". Even if good projects are outlined in the selected areas, then they will not be optionable until a decision is made. Increased funding will enable prospectors to work on those areas while a decision is being contemplated.

3) The exploration industry has shown significant signs of decline in this area recently. As you are aware the reserves in the Bathurst Mining Camp area are also declining and exploration expenditures by Noranda, Breakwater Resources, and Teck Corporation have been severely cut back. The only junior company presently active in the area is Eastmain Resources. Several other junior companies have properties but are not working them at this time and apparently have no plans to work them this year, unless there is a substantial change in the markets and commodity prices.

4) Enclosed is a press release by the Newfoundland Government announcing an increase in the Prospectors allowances. Activity is quite high in Newfoundland at this

time, partially fuelled by monies made by residents during the Labrador rush in 1995. That rush was initiated partially by funding from a prospector's grant. In that case three prospectors pooled their resources to work in a relatively unexplored area. We all know that result. What we would like to see is something similar here to attract local investors to invest in the junior market instead of relying on outside investors. A success of any magnitude that can be brought into production in New Brunswick will increase confidence in the local investment community. This kind of excitement alone can be a tremendous morale booster.

5) Ideal Drilling in Beresford is building a self-contained self-propelled drill capable of drilling a hole to a depth of 600 meters. Company officials feel that they can drill up to an aggregate total of 300 meters in 3 holes or less for $5000 with this drill rig. For prospectors who would like to drill a short hole on their property this would be very beneficial. With increased funding to the MESP, a prospector would have a chance of doing this. The individual prospector would be responsible to prepare the site if it is within their means to do so.

6) Suggestions for use of increased MESP funding are as follows:
a) Diamond drilling. To cover the contract costs the applicant's contribution can be site preparation, core logging(if qualified to do so), trail cutting, and anything that he/she is capable of doing.
b) Grid establishment and modern geophysical work, complete with computer drawn maps. Use of Max-Min and Omni instruments with data computer plotted on mylar or a similar material. Contract costs only.
c) Assays of drill core or rock or a soil survey including consumables used to perform the survey. Something to enhance a property.
d) To hire a geologist to map the property, log core, and/or to write a report.
e) In the second year, if a property is not marketable with geophysical and/or geological data then an application can be made for a drill hole if there is a clearly defined target that has been recommended by a professional geologist.
f)Any combination of the above, designed to enhance the project and to go directly into the ground. Reimbursement would be based on invoices marked as paid by the

contractor or in some other way validated for payment. The grant approval might have to be used as collateral for a loan or line of credit so the prospector can pay the invoice. It is recommended that some of this additional funding should be reserved for allocation at the end of July or August so properties with significant new discoveries can get advance funding for the New Brunswick Open House in November and/or trade shows in the winter months.

Thank you for your consideration in this important matter. We look forward to your response."

Comments from DNRE and DEDTC

- Mining Week activities should be increased and given a higher profile, perhaps linked to other promotional efforts; more attention to education and public awareness; prospecting "packages" with maps and miscellaneous information, made freely available to the public at GSB offices; six-week training courses for "prospecting parties", followed by actual prospecting in selected areas under the supervision of an experienced prospector/geologist (not GSB staff); materials and instructor's fees could be provided by a small grant for each participant, and/or a supplemented prospectors' assistance program; site visits to prospectors' trenches could include providing a short written summary of the local and trench geology, which would improve the quality of assessment reports, as well as the Available Mineral Properties publication.
- MESP is a useful program and the budget should be increased to $80,000 so that the experienced prospectors can receive around $2,000 per year. The properties discovered by Don Ward, Reg Cox and Rufus Smith highlight the importance of prospectors to the exploration industry. There is also a demand for prospector training programs. We should indirectly support the programs by sponsoring them in some way (materials, equipment, meeting rooms, etc.)
- The NBEAP program is comparable to programs offered in other provinces. We would not suggest changing the current level of funding. NBEAP indicates to Juniors that we are interested in their business and want them to come to NB. We have been told that NBEAP and the excellent service that Juniors receive form our regional offices are a strong incentive for them to come to the province. Tax breaks may also be a good incentive but we don't think that they should replace NBEAP. Quebec has both programs and we could also.

- Prospecting and prospectors are an integral part of the exploration sector in New Brunswick; always has been and will continue to be. Prospector courses are certainly one method to increase the number of prospectors in the field. A variety of courses have been offered both by DNRE and by the private sector over the years. In one series of courses that we were directly involved with, over 300 individuals took the prospecting courses. Some took the course for educational purposes (ex. teachers), others were looking for a retirement hobby, while perhaps 5% turned out eventually to be bona fide prospectors.
- Besides the generic type prospecting courses, one could offer specific seminars or workshops geared to upgrading the current knowledge level of prospectors. Some of the specific topics would obviously include discussions on mineral deposit models, interpreting the latest airborne data, etc., but should also include discussions on how important communication and data presentation skills are, especially for those going to major conferences like the PDAC.
- Another suggestion is that perhaps the Minerals & Energy Division should look at offering bona fide prospectors a discount on publication purchases as an incentive. Recent comments expressed by some prospectors after the last release of coloured airborne geophysical maps reflect on the issue that $15/map was too high a price for them.
- The Minerals and Energy Division should hire someone to travel the province and provide guest lectures and instructional materials to elementary, junior and senior high school students on the basics of geoscience and the career opportunities in the minerals and hydrocarbon industries (including prospecting as a hobby for example). This person's activities should be coordinated with the Department of Education and the local school districts. It seems obvious to us that New Brunswick school children are for the most part never exposed to geoscience or the career possibilities in it. There are a few of the larger schools which offer a token course in geology or more likely geography, but rarely ever by a knowledgeable teacher! If we want to bring people into prospecting, earth environmental sciences or earth sciences in general, we have to reach them when they are young, before they have made alternative career or life-style choices. Every school student should be exposed to two or three such lectures (or perhaps workshops) during their school career. A single lecture, say in grade five is not enough. The very least that can come of this is a citizenry more aware of the earth and its environment. Something which is desperately needed. The possibility of funding this position through the Education Department and The Mining Association should be explored.

- Training of prospectors should be recommenced. The course should be free and given by competent people from the private sector. As course aids and for loan to prospectors, government should purchase 10-12 electronic beep mats, 5-6 VLF units, some more magnetometers, a large number of geochemical diagnostic kits and rock-mineral sample kits. Every course graduate should be given a chit worth $50 if used for sample analysis.
- Adventure tourism prospecting, hobby and part time prospecting, sale of craft jewellery incorporating provincial minerals, fossil hunting, sale of fossils and mineral specimens all should be promoted under the same prospector development program.
- DNRE should have people assigned to studying and reinterpreting the considerable amount of ground and airborne survey data generated over the years not only by government but by companies. They should be continually putting out ideas on the prospectivity for occurrence of a variety of minerals in a way that will attract local publicity , incite interest in prospecting and also achieve the wide dissemination made possible by the world wide web.

3.8 Deep drilling and exploration technology

Private sector

- Government needs to encourage more drilling, even at the expense of other types of exploration work, if ore bodies are to be found. There should be no preferential support of deep drilling. Perhaps all surface drilling expenditures by any explorer, except for delineation of a known deposit, should be matched between now and when Brunswick is predicted to run out of ore (2006?) to a limit of the previous years tax revenue from mining. This would give a solid test of the province's resource potential while the mining industry is still generating some tax revenue, and, if metal prices improve in the next few years, would result in the province "making hay while the sun shines". It could be a more productive alternative than the NBEAP program and could supplement MESP grants.
- For the Bathurst camp, the province should consider adopting a deep drilling incentive program similar to the Quebec program applicable to the Abitibi area, i.e., grant up to $50,000/hole for drilling beyond 400 metres to test a geological or geophysical target, but not to acquire detailed knowledge about a known deposit (deep drilling financed by sale of flow through shares does not qualify). Reimbursed to the $50,000 limit are 50% of actual costs for drilling from 400 to 1000 m and 75% beyond 1000 m.

- Not likely (that mining employment will return to previous levels), at least in the Bathurst camp, unless innovative techniques such as Noranda is employing (seismic) prove successful and lead to a new wave of exploration. EXTECH didn't employ airborne deep penetrating EM, but should have! Instead, for seamless data set reasons, a frequency domain type with 30-40 m depth penetration was used. A fixed wing aircraft equipped with deep search technology would have had more impact on exploration investment. There still has been no government-funded deep search by fixed wing, nor, to my knowledge, has industry submitted such results for assessment.
- (Exploration success will be) more a matter of "thinking smart", as evidenced by current Noranda seismic and other such innovative methods noted above.
- Unless we have a deep search method in the Bathurst camp, the discovery potential not going to get any better. Innovation is needed. Government needs to do work to establish credibility of the potential for new deposit types and exploration methods for these, e.g. the Sewell Brook type of base metal deposit found by Novagold and which doesn't appear to respond to airborne methods.
- ...the province shouldn't be directly involved in commercializing technology by legislating its use or by constructing facilities.
- Exploration Research - The time required for the discovery and development of new mineral deposits in the province demands that all geological, geochemical and geophysical work carried out by the departments responsible must have direct and immediate application. This work should be directed to : (1) the extension of reserves at known deposits and (2) the discovery of new deposits. Limited provincial funds and the shortness of time does not allow for what may be considered to be esoteric research. Staff must be required to justify their project proposals on the basis of their application to discovery and development.
- Competitiveness of our mineral industry ...depends on technology development. (New Brunswick's mine operators) demonstrate an eagerness to innovate and adopt new technology. This attitude should be fostered by the province.
- (With respect to the kind of product from technology developments most likely to trigger exploration and discoveries), the most successful incentive that I witnessed for exploration companies was in Quebec in the early 1970s I believe. It was a Questor airborne survey extending from Chibougamau to the Ontario border. Black dots indicated EM anomalies..... I think the NB government did some airborne work but this had very little impact on the

exploration community. I can't recall exactly what they did but I sure remember the Questor-Quebec survey that launched a staking rush and much ground follow up and drilling.

- Drilling is important to encourage, but it is more important to get people out breaking rock and having analyses done. Even road cuts that have been exposed for years have been found to have gold not suspected by passers-by.
- The $ expenditures are perhaps less important than the level of cleverness in the exploration.
- Drill core storage is one of those projects which is probably under utilized, because we all go rushing off to do new things rather than take the time to assimilate all that is available. More use might be made if 1:250,000 maps were prepared which index the core available. Nova Scotia does this and it is convenient. Maybe NB does, and I just have not asked the right question recently enough.
- One (technological) category that is perhaps not featured as much as it could be is the gravity data. While I understand that the digital data can be printed out for any 1:50,000 sheet, I don't notice people having this done much. The older sets of 1:250,000 plots could be updated to draw attention to regional features. The gravity data base could be filled in more around granitic bodies with skarn potential....
- While the current program of re-describing the massive sulphide deposits of the Bathurst area may make the information more accessible to newcomers, I think more bang for the buck could be gotten from some research on deposit types which are being ignored, and which may not have been correctly interpreted.
- Another example where some clever research could inspire work would be to do microprobe work on minerals in the layered rocks in the Mechanics Settlement, Duck Lake, Stewarton, Becaguimic and Goodwin Lake-Portage Brook mafic complexes with a view to defining the horizon most likely to contain PGE, on the model of the Bushveld and Stillwater complexes. There are also other cases where a modest expenditure could trigger considerable exploration, which, even if not successful in finding a mine, would stimulate the provincial economy.
- (The core storage facility) ..is a very important library which must be preserved at all costs....It is hard data. Additional info could come from enforcing accurate water well logs and through the analysis of chips on a meter by meter basis as in RAB drilling.
- Have DNRE budget a diamond drill program to test hole prospective areas where there is little outcrop or on prospectors showings. Allow prospectors to use DNRE drilling as assessment credits.

- Re-log old drill core at DNRE locations in the province, to bring it to current terminology.
- Increased MESP funding should be made available to cover drilling costs for short holes. If a drilling contractor is used, the applicant's contribution can be site preparation, core logging, trail cutting, and anything that he/she is capable of doing.
- Suites of core from the core libraries should be made up for representative deposits and their host rocks. These suites should be mounted so the display is mobile and can be taken to trade shows. Also, they should be in Mines Branch offices so as to improve awareness by visitors and shorten the learning curve for those explorationists new to the province.

Public sector

- Although the Bathurst Mining Camp has been explored since 1950s, there remains a good potential at depth. Most of the deposits (90%) found to date are very close to the surface. Because of complex folding, some should be repeated at depth! Further more most of the 50 or so significant deposits were found in the 50s and 60s using old geophysical techniques. So, there is a good probability (50%) to find extensions to these deposits using modern geophysical and geochemical techniques; one of the such technologies is Three-D Seismic. The up to date geological maps and alteration models will also aid in finding the extensions to these deposits.
- We are not sure if the drill core program is an incentive for exploration, but we are sure that is an aid to anyone carrying out exploration in the province. The core storage facilities, especially Madran, are extensively utilized by exploration and mining companies. Marico utilized the Fredericton facility studying chips before they started their drilling program. If an up to date inventory of the core stored by the Minerals & Energy Division were on the web, it may help promote the program.
- It is a positive step for UNB to have recently appointed a Chair in Economic Geology. Hopefully, the person in this position will provide a much needed link between academia and industry and therefore instill some guidance to the types of applied research at UNB which would benefit New Brunswick's metal, industrial minerals, and hydrocarbon sectors.
- Look under glacial overburden. The good rocks are below. Use existing methods and try new methods for "seeing" through the overburden. Too few companies are using "cutting edge" techniques. GSC research is not appreciated or accepted because companies do not understand it. They probably will do so in 5 years.

3.9 Geoscience data base, expert advice to industry, and promotion

Private sector

- On balance, the database is very good and efforts are being made to promote investment. The following thus are suggestions for improving and not meant as criticisms.
- The Mines Branch gives the unintended impression of being protective of geodata bases. One can't modify or customize the maps which are on the Mines Branch computer CD ROM, unlike in the case of EXTECH data. Most popular software packages don't accept CARIS. Instead, popular packages are MAP INFO and ARC VIEW. The Mines Branch needs to be more proactive and pro-exploration in their data availability and in respecting the universality of information utilization. One should be able to very readily translate present map and other data into popular formats. In the case of claim map data, one can get digital files from Mines Branch, but there is no linkage between claim number and owner because the attributes are in a different format and there is no readily available translator.
- Ideally, geodata should be available via Internet.
- Government should sit down and prepare a practical application "cook book" or "how to" book on utilizing all of data which has been generated for finding mines, i.e., all of lithogeochem data, airborne data, etc. There is a need to fast track use of data by people who come into province so that in 2-3 days such a person can get familiar, see targets, conceive of possible targets and do rankings.
- Much older mapping has been redone in recent years, but doesn't demonstrate understanding of the relationship between, say, felsic volcanics and base metal deposits. Favorable areas should be highlighted rather than "washed out" on the maps. Examples are skarn not being shown because it wasn't a rock type or sedimentary horizons not highlighted or shown even though they are where significant lead zinc zones occur. Almost all mining companies are target oriented. Only the very large companies do concept-oriented regional work, but for this commitment they want to tie up larger land packages than are likely to be available in the Bathurst area.
- In the south, there should be more done in areas of new gold discoveries. Timely studies should demonstrate how the mineralization fits into the regional framework and a report should be (have been) prepared for handout at the PDAC conference such as was done by Newfoundland (i.e., Bruce Ryan's report) before Voisey's Bay caught on. As it is now, the Mines Branch takes too long to get out such reports before the interest fades. Synthesize

and interpret data gathered in previous years, in some cases several decades ago, i.e., Caledonia mapping and airborne surveys, Riley Brook, etc.

- [Is government work on known mineral deposits helpful?] Yes, but much of this work has been done on claims or leases held by majors and may not all have been published and what was published could have had a greater impact if published on a more timely basis.
- [If so, what deposits or kinds of deposits should be the focus of such work?] Concentrate on zones less well known, but with economic merit. Even in the case of the Bathurst area, there hasn't been a published update on the mid-1950's compilation of mineral deposits by Dr. McAllister. Such an update should be augmented by more recent data and the availability for examination in Mines Branch offices of polished suites of core from all relevant rock types, in sequential context and giving an understanding of scale on a zone (deposit) by zone (deposit) basis in the case of alteration, etc.
- [Should the Internet be used to facilitate access to the province's geoscience data base and assessment files?] Yes, definitely.
- [If so, in what way and in what priority should the different types of data be made accessible over the Internet?] Maps, assessment data and claim maps.
- [Is the current computer-accessible data in a user friendly format?] No.
- [If not, how could it be improved to enhance the efficiency of the exploration process?] Much information up to about 5 years ago is already on CD ROM. All that needs to be done is to translate so it can be put on net in popular format. Key words are important.
- [How would you prioritize the Internet as a promotional tool versus any other alternative of which you are aware?] Very high.
- [Should mineral assessment files become publicly accessible sooner than the present 2 years after data is submitted by claim holders?] No.
- In the case of airborne survey data, it should be a requirement to submit within 2-3 years and the Mines Branch should enforce the Act in seeing that it IS submitted. At least 2 large firms have flown significant portions of the Bathurst camp within the last 10 years and none of this data appears to have been submitted. If there isn't a provision for obtaining a permit to fly an area, one should be required under the Act so that the Mines Branch knows who is flying and can enforce submission of the data within 2-3 years. If something like this is not done, very valuable data is lost.
- [Does the drill core storage program serve as an incentive to mineral exploration? More so or less so than in other provinces? From an investment promotion perspective, how should

it be modified?] Yes, but if a firm makes the effort to bring in core there should be some assessment credit incentive to do so and submit the data. If claims are dropped some minor amount of credit could be given toward an existing or a new claim group. If such credits were not used within two years, they should be forfeited. As noted in answer to the previous question, much airborne survey data hasn't been submitted and perhaps some such scheme, if used in conjunction with powers available under the Mining Act, would result in this airborne data coming into the public domain.

- Promotion should focus on PDAC and Western Round Up. CIM is not so important now to exploration people. Booth should have more "hard" data, not just paper. Show samples of promoted targets to complement "Properties Available" book and regional models. Industrial minerals should be promoted at the International Conference on Industrial Minerals.
- Geoscience survey data is of good quality, but appears oriented primarily toward major companies with respect to area (Bathurst) and format. There has been sufficient detailed mineral deposit research on base metal deposits in the Bathurst camp, such as Heath Steele. *Recommendations:* A greater proportion of programs should be outside the Bathurst camp and, when possible, they should be designed to facilitate and encourage exploration for a broad range of commodities rather than, for example, just base metals. Some programs should focus on creating interest through proposing prospect models or concepts and identifying prospects that have potential for commodities other than those for which they might have been previously evaluated.
- Computer searches of the existing geoscience database are cumbersome and must be done at DNRE offices. The database is limited. Many of the identifiers are unique and should be buried in the computer program. *Recommendation:* Reports, maps, mineral deposit files and assessment files should be made Internet accessible, searches should be simple and titles of documents should be chosen to maximize N.B. database "hits" by those doing mineral commodity or geoscience information searches.
- In providing expert advice to industry and other government departments, DNRE is unduly competing with private sector consultants. Recent examples are DNRE study of aggregates for the private sector builders of the Trans Canada Highway and geological surveys or studies requested by municipalities. *Recommendation:* DNRE should formally adopt a policy of maximizing employment in N.B. through fostering entrepreneurship and involvement by N.B.-based firms whenever there are requests to DNRE staff members for advice or studies which

would detract from the role of those staff members in doing surveys or otherwise improving the geoscience database for the purpose of attracting investment.

- The investment promotion effort of DNRE is insufficient, too narrowly focused on the metal mining/exploration sector and has not taken advantage of the promotion that can be accomplished through dissemination of geoscience information over the Internet. *Recommendations:* In addition to having an information display and resource person(s) at the metals-oriented annual Prospectors and Developers Association Conference, make a similar effort addressed to the petroleum industry annually at their senior exploration focused conference in Canada or USA. Such promotion is timely because the economics of gas production from small fields could be enhanced by the presence of the pipeline scheduled for completion in 1999.
- Systematic bedrock mapping is the keystone of a good geoscience database. Thorough 1: 10,000 scale mapping in key areas is necessary. The Newfoundland Department has a serious team of mappers. N.B. has adequate personnel but needs the leadership required to back a superb mapping team. Broad-brush, road, and stream traverses are no longer adequate.
- [Are there areas of the province or geological environments which require more survey work by government? If so, where, what types of survey should be carried out and to what level of detail?] The Department has tended to follow mining companies' activities rather than initiate their long term mapping policy. The Caledonians are an example of an undermapped area mostly because mining companies have showed little interest.
- [Is government work on known mineral deposits helpful? If so, what deposits or kinds of deposits should be the focus of such work?] Yes, it is helpful and leads to a better understanding of areas such as the Bathurst camp. New work could include studies for metals outside of the favoured camps such as a phosphate search in the Pennsylvanian.
- [Should the Internet be used to facilitate access to the province's geoscience data base and assessment files?] Of course, use every available tool.
- [Should mineral assessment files become publically accessible sooner than the present 2 years after data is submitted by claim holders?] No, two years is a good time, allowing juniors or independent prospectors enough time to coalesce their ideas, properties or funding.
- [Does the drill core storage program serve as an incentive to mineral exploration? More so or less so than in other provinces? From an >investment promotion perspective, how should it be modified?] This is a very important library which must be preserved at all costs...It is

hard data. Additional info could come from enforcing accurate water well logs through the analysis of chips on a meter by meter basis as in RAB drill programs.

- [Promotion?] In the present, the PDA, CIM conventions and the status quo in prospector support and promotion of properties should be maintained. The Internet will become increasingly useful and should be aggressively developed to not only promote but give access to available data.
- The geoscience database is OK, and is constantly growing. It is essentially a work in progress. Nevertheless, it must be remembered that if the information gathered in the field by DNRE is not extremely accessible by the public, then there is no economic benefit in gathering it.
- Mineral deposits research has been going on for years but we won't be able to tell its usefulness until some of this work can be used by more than one company. Such work should be done on all deposits with apparent potential, not just those in the Bathurst area.
- The existing database is NOT in a user friendly format for computer processing. All data and claim information should ultimately be accessible via the Internet. Of immediate priority would be the mineral properties of prospectors that currently are available for option, all with key words to ensure hits with commonly used search engines.
- Mineral claim assessment data should continue to be confidential for 2 years after submission because, otherwise, claim holders will not submit or are less likely to submit all data.
- The drill core storage facility should be manned year around and there should be a number of cubicles to allow more than one person to examine core at the same time. Also, a few 8' X 16' areas where people could log core would encourage companies to bring in the core at their own cost. Otherwise, the facilities and core data access are good services.
- Promotion at the PDAC is very useful, however, the focus of those attending the Western Round Up is on the Cordillera and the benefit of promoting at this latter conference is questionable. It is enough for 2 prospectors to be given assistance to attend and exhibit property info at the PDAC. The objective should be to promote those properties with the best potential rather than risk diluting the effectiveness by profiling too many. DNRE should help in whatever way necessary to gather data and in presenting it so that exhibits are professional and appealing to prospective investors as possible.
- The geoscience database is a good mix, particularly the EXTECH data for the Bathurst camp. The problem is that it is not promoted and interpreted to industry by DNRE.

- The work currently underway in the northwest of the province is an example of doing the right things. Perhaps gold in the Carboniferous should be investigated and promoted.
- Mineral deposits research is helpful, but should be extended to timely release of studies on new discoveries such as the two recent gold discoveries in the southwest. Work should be done to demonstrate similarities between N.B. geological environments and those in productive mining districts, such as the Carlin belt of Nevada. To document and publicize the basis for such analogies would attract investment.
- The Internet should be used extensively to facilitate access to the geoscience database. Of highest initial priority, should be access to information on mineral commodities, lists of reports and maps for sale, and, properties for sale or option.
- Currently, computer accessible data is not in a user friendly format as it is in CARIS rather than a universal DXF or Arc Info format.
- In the case of drill core, suites from various deposits and their host rocks should be made up and put on display in DNRE offices for promotion and shortening the learning curve of those new to the province.
- Promotion at the PDAC is good. Support of 2 exhibiting prospectors is adequate. Perhaps additional focused promotion would help, i.e. identify people with N.B. roots on boards of directors and directly pitch the potential and investment attractiveness of the province to them. Convince the Premier to speak to Engineer's clubs and visit top management of selected mining companies in Toronto and Vancouver, carrying the open for business message.
- Geological, geophysical, geochemical and other data related to mineral exploration, development and production must be available quickly, efficiently and at a very reasonable cost.
- Is the government of New Brunswick willing and able to improve the quality of legislated services it must provide to the mineral industry? Would the department responsible consider the possibility of being the first in Canada to qualify for ISO9000 certification? New Brunswick is in competition with other provinces for the exploration dollar and it might be very successful in attracting this capital if it establishes a reputation for providing the highest quality of service in the country. Would it be an unrealistic objective to issue the required permits, etc. ("etc." undoubtedly referring to data as well) faster than any other similar department in Canada?

- Compilations and interpretations of existing geoscience data would be of benefit. It is hard to say whether the existing data base is adequate for maximizing long term benefits. Probably a "steady state" with respect to data gathering and distribution is appropriate.
- DNRE should be flexible in choosing areas to survey and types of work as it should either anticipate commodity investment trends or seek to promote promising discoveries on a very timely basis.
- The Internet should be used to facilitate access to the geoscience data base and assessment files. Raw data, plans, maps, sections from deposits, etc. should be downloadable. The Internet and DNRE "show & tell" sessions are the most important for promoting interest by investors. The CEO of a different target major company should be invited by the Minister to give a keynote address each year. Likewise, senior technical managers should be invited to participate in panel discussions or to have a company exhibit. These measures would help draw senior people with more influence over investment decisions.
- Only if government funds have contributed to generation of assessment data should it be made publically available sooner than 2 years.
- Yes, the geoscience database is adequate. There is no need for any particular type of survey. With the DNRE budget, the government is covering the province effectively. Government work on known mineral deposits is not helpful.
- Yes, the Internet should be a top priority as a promotional tool.
- No opinion on assessment data confidentiality period.
- Yes, the drill core storage program serves as an incentive to mineral exploration.
- Don't know (whether the investment promotion effort of DNRE is adequate) as we haven't been able to compare the promotional effort of N.B. with other provinces. The Internet may be a more effective and less expensive promotional option. It is odd that the majority of promotional funds lie with Economic Development and not DNRE. Attracting call center jobs versus mining jobs seems to be a priority.
- The level (of geoscience database) is adequate as is.
- [Are there areas of the province or geological environments which require more survey work by government? If so, where , what types of survey should be carried out and to what level of detail?] I think that the governments is doing a good job in this sector.
- [Is government work on known mineral deposits helpful? If so, what deposits or kinds of deposits should be the focus of such work?] It is helpful, but not a priority. What we need

is to attract new players think that juniors will be the ones that will create the momentum that will stimulate the exploration activity and as usual major companies will follow.

- [Should the Internet be used to facilitate access to the province's geoscience data base and assessment files? If so, in what way and in what priority should the different types of data be made accessible over the Internet? Is the current computer accessible data in a user friendly format? If not, how could it be improved to enhance the efficiency of the exploration process? How would you prioritize the Internet as a promotional tool versus any other alternative of which you are aware?] Yes the Internet should be used, we have potential here in N.B. and we have to let the mining world know that we are open for business and show the investors and all mining exploration concerns the mineral potential that we have.
- [Should mineral assessment files become publicly accessible sooner than Claim-holders submit the present 2-years-after data?] No, because of the possibility that some claim holders may not submit all of the data?
- [Does the drill core storage program serve as an incentive to mineral exploration? More so or less so than in other provinces? From an investment promotion perspective, how should it be modified?] It does not serve as an incentive, but is very important aspect of our exploration catalogue.
- [Is the investment promotion effort of DNRE adequate? The annual minerals promotion budget of DNRE is approximately $20,000, including the Annual Review of Activities, PDAC and Western Round Up attendance and exhibits. Is the mix of its focus on the industrial and metallic mineral sectors appropriate? What is the most cost effective promotion medium for informing the greatest number of prospective investor representatives at the least cost, i.e. PDA or CIM conference displays, funding the cost for prospectors with prospect information to attend such conferences, key word discoverable Internet data on all types of mineral occurrence and geological environment in the province?] The Minerals Division of N.B. does not have a big enough budget to promote our mineral wealth. It is very important that they attend conventions and promote our province any way they can. Sending prospectors to these conventions is a minimal cost relative to the potential returns, that being said I do not think that the government should support prospectors on an annual basis. One should look at the merit of the property. Such property should have high potential.
- I find a good mix of information for the things that I have taken on in recent years, so am not in a position to comment on the presently available digital files, but sense from others that they are useful.

- I find the present 2 year confidential period for assessment reports to be reasonable. This gives enough time for a claim holder to respond to new information. The gap in availability of assessment files is getting the microfiche up to date for the half of the province where they are not! These were intended to be forwarded every month, as files became public, or so I thought. At present, they are years in arrears - I presume due to someone thinking they were saving the taxpayers money. There are a number of little projects I have thought about researching but set aside because of the cost of driving to the other half of the province to see some files. The distribution of fiche to public libraries, a noble intent at the beginning of the fiche program, seems to have totally collapsed.
- Drill core storage is one of those projects which is probably underutilized, because we all go rushing off to do new things rather than take the time to assimilate all that is available. More use might be made if 1:250,000 maps were prepared which index the core available. Nova Scotia does this, and it is convenient. Maybe N.B. does, and I just have not asked the right question recently enough.
- (With respect to promotion), I am surprised to see that so much gets done with so little money. I feel the N.B. & federal governments are making quite a credible effort in promoting N.B.'s mineral potential and enhancing the scientific information available.
- It could be helpful to support prospector's displays at PDA more than in the past. I think that NS and NF are more generous in this respect.
- As commented above, some newcomers to the province might be enticed by having the mineral occurrence file on the Internet.
- Governments should let industry manage exploration, development and operations. They can assist by providing geological information, assisting with technology development, assisting with managing regulatory issues and becoming partners in growing the industry (regular communications, remove roadblocks, etc) Deposits that are marginally viable or non viable should be targeted.
- The geoscience database of New Brunswick is considered reliable but the number of performed regional exploration surveys and covered areas are too low. Emphasis should be put on regional geological mapping, geochemical (lake, stream sediments) and geophysical (airborne) in areas of interest. These grass-roots type of surveys would effectively support the prospectors, the junior and senior companies. As an example, such regional surveys should be performed over the Miramichi zone (favorable lithologies located east of the Bathurst mining camp) to evaluate the potential to host other massive sulfide deposits.

- Geological academic research should have a global vision since mineral deposits depend on similar geological parameters that are found in all areas and/or countries. To be most efficient, the academic research should be properly balanced between New Brunswick and foreign projects. The proportion of current academic research performed on New Brunswick projects is considered favorable.
- New Brunswick should develop Internet links to give access to the geoscience database, the assessment files and the mining land titles data. Several Internet tools should also be developed to promote certain favorable exploration areas and to simplify the communication between the mining industry and New Brunswick Government. Most favorable research results should be shown on the Internet with emphasis on new mineral discoveries and indices.
- Diamond drill cores should not be handled by the New Brunswick Government.. An initiative program should be established to promote responsible diamond drill core storage by Industry (assessment credit for core storage). Each company should be responsible for its own core.
- The investment promotion efforts of DNRE are inadequate.
- N.B. is a reasonable place to do business but it does not market itself well. We have an image of wanting our economy to be based on high tech industries when in fact our bread and butter is our natural resources. The N.B. government must decide at a high level if the mineral resource industry is important and if so, promote it top-down. Appropriate people must be put in place to sell the message. Manitoba could provide some insight into how this is done. Avenues for selling the message should include: international trade missions (high profile), Mines Ministers Conference, mining conventions (CIM, AIME, PDA, etc). The key is to get the mineral industry on the Premier's agenda. More money should be earmarked for promoting the mineral industry in schools, during mining week, in magazines, etc. $20K appears to be one order of magnitude low for this purpose.
- I do feel strongly about one issue which I believe should be addressed - a geological data base designed to be used by the mineral exploration industry. I believe that other commercial mineral deposits remain to be discovered - not only in the Bathurst camp, but in other geological environments not identified and described in the province. Almost every time I carry out geological field work I recognize outcrop features significant to the occurrence of commercial mineralization which are not shown on the provincial geological data base. This omission can and should be corrected.

- A nucleus of geological expertise should be established within DNRE with individuals experienced and knowledgeable in geological environments which contain world-class commercial deposits. The province should then be re-mapped with a focus on these geological environments in the field. Significant relevant outcrops and drill holes should be identified and described. The information will attract explorationists and the discovery of commercial deposits will follow.
- My only criticism regarding the present climate for mineral exploration in New Brunswick is the lack of an emphasis on fieldwork which is relevant to economic geology. This must be corrected.
- I have no valid comments on your points such as investment climate, land tenure, promotion, drill core storage, incentives, assessment files, etc. The province is certainly a favourable area to explore from these perspectives.
- I do not see the Protected Areas Strategy as a deterrent to exploration.
- [Does the geoscience database consist of the appropriate mix of geological mapping, geochemistry and geophysical data to most effectively support prospectors? Junior companies? Senior companies? Do we need more or less of any particular type of survey?] Excellent database.
- [Are there areas of the province or geological environments which require more survey work by government? If so, where , what types of survey should be carried out and to what level of detail?] None come to mind.
- [Is government work on known mineral deposits helpful? If so, what deposits or kinds of deposits should be the focus of such work?] Always helpful. Generally focused on the right areas of study.
- Internet good for promotion. Have a web page with exploration updates, coming reports etc. I would not think it practical to try and digitize the assessment database. This was done at one time as compilations but even that proved too difficult to maintain with low budgets.
- [Should mineral assessment files become publically accessible sooner than the present 2 years after data is submitted by claim holders?] It was an incentive for more complete filing, particularly just prior to abandoning. How many companies have re-staked an area within 2 years of dropping it (besides Noranda?)... Perhaps if someone physically stakes and legally acquires the mineral rights they should be granted access to these data at that time.
- [Does the drill core storage program serve as an incentive to mineral exploration? More so or less so than in other provinces? From an investment promotion perspective, how should

it be modified?] Core storage is essential but must be realistic and managed so it doesn't become an excessive burden (i.e you don't need every hole from a MS deposit but exploration holes are more valuable).

- [Is the investment promotion effort of DNRE adequate?] Get on the Internet. I can't believe $20,000 covers all the current activities which are the bare minimum needed. Mineral deposit geologists should be traveling the continent/planet to see other districts and bring back ideas, new contacts and enthusiasm to the department. Nothing changes if everyone is sitting in the same office and looking at the same outcrop for 20 years..... (just an expression!).
- Is the provincial geological program driven by the industry? What proportion of the program is self-serving? Who audits the output? How much of the program is practical geology and what amount is research? I remember the discovery of the potash deposits. Does the same zeal exist? How many prospectors and/or juniors visited the geological offices in 1999 and each of the previous 5 years?
- The geoscience database is of limited use. There is never an opinion expressed in reports by DNRE geologists about economic potential. They should do more postulating and prognostication based on data in the files.
- Government studies on known mineral deposits is helpful in that it adds to the geoscience database.
- Two years assessment confidentiality is fine.
- Drill core libraries are very important. The core is extremely valuable. It should not be condensed. Field trips should include visits to core storage facilities from time to time and include examination of some good examples of the geological section at ore deposits in the province.
- The PDAC is the most important conference for promoting interest in prospector properties. Other conferences are either not focused on exploration or on this region. Only the few prospectors with the best prospects should be assisted in attending and exhibiting. If low quality prospects are included, the interest will not be focused on those that have the best potential to attract investment.
- The Current Research volume handed out at the Annual review of Activities undoubtedly takes a lot of valuable professional time to prepare. Yet, almost all recipients just put it on their book shelf without reading it! It doesn't thus serve any useful purpose and some more objective driven activity should be occupying the time spent in its preparation.

- Draws for door prizes and hand out of canvas bags with the DNRE and provincial logo have no influence on mineral industry investors and the money could be spent more productively.
- Reports on commodities (lead, zinc, copper, indium, various industrial minerals, etc.) would help in promotion, particularly if prepared with attracting investors in mind and available for downloading over the Internet.
- The geoscience database is reasonable, but not enough attention has been given to certain geological environments such as the Carboniferous. All new forest roads should be mapped as well as new highway cuts and pipeline ditches.
- Models have been dreamed up, but more DNRE and other people need to be breaking rock out in the field as well as pouring through the existing database for clues and to reinterpret in light of new concepts and data.
- Work on mineral deposits is helpful. DNRE should continue to develop information on a range of deposit types.
- If claims are allowed to expire, the 2-year assessment confidentiality period should not apply.
- The core storage libraries are very important. No modifications are suggested.
- Field trips are an effective promotional tool, particularly to show off new ideas and mineral occurrences.
- Assessment files should be confidential as long as the property owner wants confidentiality.
- Assessment work credits should be transferrable from property to property that are owned by a company. This could help companies with numerous properties that may find it difficult to meet all their yearly work requirements. If a property is loaded with assessment credits but has no smell of anything of interest the current procedure is to hold on to it as long as there are work credits. Wouldn't it be better to drop it, transfer the credits where they could help hold on to something that could eventually be worked and developed into something good?
- If a company has a property and drills a conductor that turns out to be graphitic or barren sulphides, it is expected to submit a report of the results (costly to prepare a report, logs, assays, etc.), then drop the claims. In many cases, the work is not reported and the property is simply dropped. If the work credits were transferrable at 50% or 100% of their value to another property it would provide some incentive to register work. While working for Noranda, I drilled a property in Quebec that had been drilled by Noranda some 25 years previously and the work was not reported. We again confirmed that the conductor was barren sulphides!

- A *Mineral Resources Policy* ('93) goal is "to help the private sector identify new mineral reserves & enhance known reserves" through initiatives intended to "encourage private sector investment". Another goal is to "improve public awareness regarding the mineral industry". Thus, promotional efforts are to be targeted to the investment community and general public. It is difficult to measure the return from such [promotional] initiatives. Though public awareness is acknowledged as essential to a positive investment climate, it usually drops off the list when priorities are established. There has been an effort to coordinate stakeholders' awareness activities to ensure the 'best bang for the buck' (eg. Mining Week Coordinating Committee). DNRE's efforts over the past couple of years in this regard are supported by the N.B.MA.

  Generation & dissemination of baseline geological information consumes a large part of Mineral Resources Branch annual budget. Thus, DNRE efforts to market our mineral resources encompass more than the $20K spent to attend conferences and develop exhibits. It should be recognized, though, that the total 'marketing' budget for minerals isn't believed to compare to investments made promoting other sectors, such as tourism.

  The "mix of focus" on industrial and metallic minerals should be predicated on the potential for achieving results. If this query refers to activities such as conferences and exhibits, it is assumed there is a process to evaluate proposals and that decisions are based on the specific deposits to be promoted, be they industrial or metallic minerals. It must be emphasized, however, that no amount of money spent on such activities can compare to the impact on the investment community of a succinct clear message that "*We want mining in New Brunswick*".

  The question (of the most cost effective promotion medium for informing the greatest number of prospective investor representatives at the least cost) must be considered not only in the context of policy objectives, but in terms of anticipated benefits. Thus, the question is apropos. But no one single medium is most cost effective. The message (and the medium) must be tailored to the target audience.

  The question then becomes do we need better tools or do we need to use existing tools better. An evaluation of the (cost) effectiveness of marketing approaches should consider previous DNRE experience as well as experiences in other jurisdictions and sectors. For instance, tourism has been a focus of provincial marketing efforts. It is understood some of these initiatives have been quite innovative and quite effective.

While one medium may not meet all the promotional objectives, the increasing value of the Internet as a marketing tool is undisputed. It may be most useful in reaching a broader market and perhaps building a more positive (overall) perception of N.B. mineral potential. As use of the net expands, so too does the competition for audience's attention on this medium. (Is DNRE's website a primary attraction for potential investors?) Thus, consideration should be given to strategic 'partnerships' aimed at getting our message on other, popular Internet sites.

- Databases are very useful but we should do more work on known mineral deposits, particularly with respect to developing secondary products. Seems to me, most of the work done in N.B. is first phase utilization, for example preparing a concentrate for market or crushed limestone for general use with very little development of value added products.

  The amount used for promotion, $20,000, is very small and much more publicity should be given in letting people know the variety of minerals available, primarily to stimulate prospecting activities. What people don't know about, is not likely to generate activity.
- With respect to generating geoscience data, the Restigouche survey is not the most beneficial choice that could have been made. Perhaps the decision was politically motivated? Airborne surveys with a discrete target-oriented component should be done over other volcanic rocks such as those in SW N.B..

  Assessment reports should only be confidential for 2 years if the mineral rights remain in good standing.

  Claim assessment data are available over the Internet for Ontario and Quebec. N.B. should do the same.

  Assessment data original documents are missing from the files of DNRE. This is orcan be very valuable geoscience information and much more care should be taken to preserve it and make it as accessible as possible.
- DNRE needs more user friendly data access.

  There is no reason for a confidential period as long as 2 years for assessment reports. Six months is probably enough as public listed junior companies must make press releases required by the securities commissions as data becomes available. Keeping it confidential does not help promote exploration competition. It protects only the large companies to whom it is not particularly material information and hence not necessarily the subject of a timely press release.

There should be provision for electronic submission of assessment data on disk or by downloading.

Over time, all the province should be covered by appropriate target-oriented airborne surveys.

Testing of new technology, whether for airborne or ground surveys, should be done through NBEAP or some such program which would ensure more widespread acceptance, as any discovery would get more publicity and industry recognition than if the test survey were done by government.

At the PDAC, more crowd drawing exhibits are needed in the rock room, ie. core of strong interest, etc. Government shouldn't be seen to be playing "flavour of the day", but should support companies and prospectors who will help make N.B. the flavour of the day.

In spending or budgeting, government should always ask "Is this going to attract investment and how does it rank with respect to other budget alternatives?"

- DNRE must take a more proactive approach in promoting use of the geoscience database. The Internet is a good idea for dissemination of data and would be a big improvement if only because, at present, information is not disseminated expeditiously or with enthusiasm in response to enquiries (for expert advice or data).Newfoundland responds much quicker and comprehensively.
- The N.B. map grid is out relative to the international grid system and this causes locational problems for prospector's data submitted as assessment , etc.
- There should be more geochemical surveys and target oriented airborne surveys.
- When doing geological mapping, there should be more consideration given to what prospectors can interpret and need to see on geological maps.
- Assessment data, imports, exports and commodity data for the province all should be on the Internet and locatable by doing searches with key words. I did a search recently for peat deposits and, even though N.B. is North America's largest producer, found no information on the resource. However, I did find a lot of information on the peat deposits of the Carolinas!
- DNRE should be more promotional and proactive, with an open shop mentality.
- We need Internet promotion of commodities and elements found in the province. Government should be more proactive in putting reports together and should take a commodity-driven perspective in prioritizing promotion and surveys.
- The geoscience database is as good as anywhere else and Bathurst is more so than for comparable areas.

There are not many obvious survey programs that could trigger investment.

The work on Heath Steele was useful.

The Internet has great potential for disseminating data as it is the first tool people now use when they go looking for information on any subject.

Assessment files should not remain confidential unless the company has a good reason to keep the data confidential.

Core library is very useful. It would be better to have the sites manned year around.

The Annual review of activities is the most important promotion venue because DNRE has the attention of the attendees. The PDAC ranks second. The Western Round Up is not particularly useful. Sponsoring of prospectors needs to be very selective.

- Each geologist at DNRE needs to be assigned not only a mapping project each year, but also should have to keep in proactive touch with companies active in an assigned area. There should be more focus on what companies are doing and assisting both companies and prospectors.

We should be allowed and encouraged to submit assessment data on disks or via the Internet. DNRE should assist those who need help. Make a template, etc.

If the government is going to continue to use CARIS, it should be given to the exploration community in the province. Otherwise, it is a disincentive.

The geoscience database is a "zoo" for the user. There has to be a better way of accessing data than pouring over microfiche.

DNRE is doing regional surveys , but should start zeroing in with more detail in areas selected by regional geologists.

Data is generally useful to all companies. More "breaking rock" evidence and detail is needed.

DNRE should assist prospectors in making promotional displays and generating analytical data. Send as many to exhibit at the PDAC as the quality of prospects warrant.

Public sector

- Areas requiring more survey work by government include northwest New Brunswick (1/50 000 and 1/20 000), the Carboniferous Platform (1/50 000), the Caledonia Belt (1/20 000) and the Woodstock area (1/20 000 (and 1/10 000?)). In each case, geological mapping and geophysics is necessary. Better geological maps are a priority for industry and the best way to produce them is to conduct airborne geophysical surveys in advance in order to obtain maximum value from the mapping. Furthermore, digital technology allows various types of

derivative maps to be produced for industry; i.e., maps containing different kinds of information in greater detail, tailored to suit individual needs.

- Is government work on known mineral deposits helpful? Yes
- *"It is unlikely that economic geology would yet have attained full status as a science had it not been for the wealth of observation collected by government organizations and correlated by great leaders who have devoted all or part of their professional careers to government work. The study and comparison of mining districts on a scale that is possible only to a group with the authority and resources of a public organization have made it possible to evolve broad and sound theories of ore genesis".*

McKinstry (1948); Mining Geology

- DNRE should seek all possible means to increase participation by UNB in understanding New Brunswick's geological and mineral heritage. A continuing dialogue and partnership with the UNB Geology Department is necessary to cultivate faculty and students willing to work in New Brunswick. In the case of graduate students, an expedited process of hiring, distinct from that of regular summer student hiring, may be required. It should be kept in mind that all parties would benefit from such an arrangement; for example, it represents a very low-cost method of adding to New Brunswick's geoscience database, an important consideration in a time of budget restraint and cuts.
- The World Wide Web, which is only a part of the Internet, is essentially a user-friendly (i.e. graphical) interface to the huge repository of data that resides on computers around the world. As such, it has become *the* starting place for information gathering for industry, government, and John Q. Public. The benefits of a web presence are many, the initiation cost is low, and the impact can be monumental (see British Columbia's Ministry of Energy and Mines' web-site *www.em.gov.bc.ca*), but only if quality control is impeccably maintained.
- Part of the mandate of the New Brunswick Geological Surveys Branch is to effectively communicate to clients, in the government and the general public, geoscience issues relevant to land-use decision making. An informed public will better understand geoscience and land-use decisions, and be more sympathetic to mining and geo-environmental issues. A well designed and maintained web-presence, is an advertisement for, and a doorway to, geoscience information, and is accessible *world-wide*. It is *imperative*, therefore, that as much of New Brunswick's geoscience data as possible be accessible through the Internet; specifically via a World Wide Web-page and an FTP-site. This is by no means a daunting task, as software programs that allow a remote user to query a database, query a map, and

even create a map, are commercially available, easy to use, and inexpensive. Furthermore, much of the requisite geoscience data exist in digital form and are sold as individual data sets by the department. A user-friendly, comprehensive, query-able web-site is an enormously powerful user-resource, as well as a first-rate promotional tool that can impart to users a good first impression of the department.

- The GSB's promotion effort is clearly inadequate. If we want to have a mineral industry, are we prepared to support, encourage and stimulate it to the extent of some other provinces? And to be seen to do so? We need more venues for booths and displays, and more encouragement and monetary support for staff to present talks and posters. Minerals and Energy Division budgets are consistently a fraction of the revenue generated by the mining industry in fees, etc. Some of this revenue should be used to support promotion activities, as well as bolstering exploration assistance programs.
- Specific ideas:

  - Discuss with EDT&C the possibility of supporting an entire New Brunswick section on the floor of the P&D Convention (service companies, prospectors, junior mining companies, etc.)
  - In addition to the usual publications, prepare audio-visual displays on new prospects and available mineral properties at the P&D, Cordilleran Round-up, etc.
  - Invest in major upgrades to our Internet capabilities, the most cost-effective medium for promotion (see above). As one of the Bathurst staff has put it: "It's like the PDA 365 days of the year".

- *Bedrock mapping:* Bedrock maps for southern New Brunswick, south of latitude 46°, are now available on a standardized digitized format at 1:50,000 scale, recommended by the Industry Advisory Committee. Plans are underway to produce similar quality maps for the pre-Carboniferous bedrock lying between latitudes 46° and 47° by standardizing existing data collected in that area in the late 1970's and early 1980's. Such maps are adequate for grass-roots exploration programs but are generally not detailed enough to allow the delineation of specific stratigraphic horizons or structural features that control zones of mineralization.
- In areas of high economic potential such as the Bathurst Mining Camp, bedrock mapping is routinely done at a scale of 1:20,000. Only a few maps are available on this detailed scale in southern New Brunswick and more are needed in areas where exploration companies are looking for specific drill targets. Although detailed geochemical and geophysical studies are the prerogative of the explorationists and require no local experience, the same cannot be said for mapping of New Brunswick's complex geology. Neither is it a requirement for the

industry to submit such mapping as assessment work, many companies preferring to keep such information confidential.

- The mineral industry in New Brunswick has matured and maps that provide only an overview for grassroots exploration are not likely to satisfy the demands of today's more sophisticated market. If the New Brunswick Mineral Resources Division is to continue to provide basic, high quality bedrock maps to serve as more specific exploration guides to a mineral industry and at the same time establish a sufficient geoscientific field database to create reliable metallogenic models, future bedrock mapping will have to carried out by the Geological Surveys Branch at a more detailed scale in areas of high mineral potential in southern New Brunswick. Indeed it can be argued that mapping on a scale of 1:10,000 would be warranted around some areas of known mineralization if the complexity of the geological environment is to be more fully documented. These detailed maps could provide the incentive for exploration companies to re-visit prospects in southern New Brunswick by focusing their efforts and thereby reducing their land acquisition expenses.
- *Surficial Geology and Geochemistry:* The present mix in the New Brunswick geoscience database is a good one for mineral exploration, as well as diverse enough to meet other demands. Several mineral occurrences were discovered as a result of geochemical surveys (e.g. tills: Rocky Brook (21 O/9), Golden Ridge (21 G/13); streams: Devil Pike Brook (21 H/12), and others less well documented).

  The availability of additional field staff, both bedrock and surficial geologists, would expedite the search for, and assessment of, other mineral occurrences. Discussion with Tim Webb also indicated that we may expand our analytical suite to assist the industrial minerals section.

  One area of current research is the search for different types of deposits in previously under-explored areas (e.g. Restigouche Belt, Carboniferous Basin). In these areas we are carrying out detailed surveys, although in the case of the Carboniferous Basin we may have to go to regional coverage to assess its full potential within a reasonable period of time. We also make use of archived materials on a regular basis to reanalyze for different suites of elements as exploration strategies change. This 'saves' time and money, since no new field program is entailed. Under certain circumstances, archived material can also be made available to private companies.
- *Metallic Minerals:* Although mineral occurrences are well documented, metallogenic models using the occurrence data are not well established. Mineral exploration models are needed

as well. Detailed mineral deposit studies might help to find extension to existing deposits. In general, work done on the Bathurst Mining Camp is far less than on similar camps in other provinces.

- *Industrial Minerals:* Attempts have been made by government to update resource inventories and compile relevant geologic data on the province's industrial mineral resources (i.e. limestone, gypsum, silica etc.). Regional geologic mapping continues to be very valuable, assisting in the recognition of geologic terrain favorable for industrial mineral deposits. For-the-most- part, the province is adequately mapped at a regional scale satisfactory for a broad-bush approach to the identification of potential industrial mineral deposits. Continual erosion of operating budgets over the past several years, prevents effective follow-up work to stimulate additional exploration and development and manage known resources effectively.

  Because of their relatively low profile, low unit value and a general ignorance related to market potential, industrial minerals do not attract interest from the local prospecting community. This lack of interest is reflected in fewer numbers of recognized industrial mineral occurrences and a general lack of relevant industrial mineral exploration data.
  The application of geochemical and geophysical support pertaining to industrial mineral deposits is limited to non-existent. This is considered to be a function of different priorities (i.e. till geochemistry focused on metallic sector), limited funds for manpower and equipment. As an example, the province has not had a staff geophysicist for over a decade. Incidentally, government-sponsored geophysical programs were critical in locating the important potash deposits in the Sussex. There are many areas of the province that would benefit from a regional geophysical component (gravity, magnetics, etc.) to identify industrial mineral resources definition (i.e. Marysville Sub-basin, Maritimes Basin, parts of the Moncton Sub-basin, Plaster Rock area etc.). Geochemical evaluation of the potential magnesium resource associated with the Millstream evaporite cores serve as only one example of the contribution geochemistry offers to the assessment of industrial mineral deposits. These geoscience techniques are seen as providing key information to a comprehensive and reliable geologic database and could be the difference between a company investing in an exploration program in New Brunswick or going elsewhere where the information is available.
- *Hydrocarbon Resources:* There are many areas of the province which are inadequately geologically mapped to realistically assess the metal and industrial mineral potential. For example, there are large areas underlain by Carboniferous rocks in New Brunswick that have

never been mapped at any scale. It is not possible to assess mineral resource potential without quality geological maps! This is doubly true with respect to Carboniferous rocks and their potential for hydrocarbon resources. The basic "building blocks" of sedimentology, stratigraphy and structural setting are indispensable to mineral and hydrocarbon assessment potential in these rocks. Based on our personal experience, the geological database is seriously deficient in areas underlain by Carboniferous rocks. It has been the most overlooked terrain in the province for decades. Several man-years of geological mapping at a scale of 1 : 50,000 or more detailed are required in large areas underlain by Carboniferous rocks to bring these areas up to the level of pre-Carboniferous terrains.

With respect to our geophysical surveys over areas underlain by Carboniferous rocks in New Brunswick, the situation is even worse than it is for geological data. Four examples are cited. First, airborne magnetic maps covering the Carboniferous Maritimes Basin in eastern New Brunswick are 1 inch = 1 mile scale and were flown in 1958 and published in 1959 by the Geological Survey of Canada. These maps are seriously outdated and wholly inadequate to assist in attempting mineral potential assessment in crystalline rocks below the Carboniferous cover. Second, the 1;250,000 scale Geological Survey of Canada radiometric survey conducted in New Brunswick in 1976 was flown over crystalline terrains but purposefully excluded the bounding Carboniferous strata of the Moncton and Cumberland sub-basins. and New Brunswick Platform. Third, the airborne magnetic and radiometric survey conducted in 1983 over the Caledonia terrain in southeastern New Brunswick excluded the bounding Carboniferous strata of the Moncton and Sackville sub basins. Fourth, the airborne magnetic survey carried out by the GSC in 1988 over the sulphide-bearing rocks of the Bathurst Mining Camp in the Miramichi Belt excluded the covering rocks of Carboniferous age immediately east of the this belt. In the latter case it is known from drill hole data that the base metal sulphide-bearing rocks of the Ordovician Tetagouche Group are shallowly buried beneath the Carboniferous and therefore in part assessable by an airborne magnetic survey. The area of shallowly buried sulphide-bearing Tetagouche Group beneath the Carboniferous immediately east of the Miramichi Belt is nearly as large as the exposed area in the Bathurst Mining Camp and it has been virtually unexplored. This is in part a result of inadequate geophysical data.

- *Academic Research:* Geological Mapping: At present there is very good cooperation between the Geological Surveys Branch surficial geological staff and UNB Geology Department surficial geology staff. Similarly, there is good cooperation between bedrock

mapping staff and Acadia University. However more cooperation is needed between the bedrock mapping staff and the UNB Geology Department.

Metallic Mineral Deposits: At one time, several UNB students and staff used to work on these deposits. During the last 10 years, metallic mineral deposits studies have become very scarce. In this regard, the new economic chair might help to undertake more cooperative projects. However, financial resources and a more flexible hiring process within the Geological Surveys Branch are needed to encourage academic research at UNB.

Industrial Minerals: Since 1987, 63 % of geology thesis at UNB relate to topics outside of New Brunswick. Considering the topics of some of the work actually carried out in New Brunswick over the last decade or so, the direct impact this work has on the provinces' mining industry, (industrial mineral in particular) is debatable at best. The Geological Surveys Branch should offer direct sponsorship (financial or other) of applied joint research projects or a mentorship-program with undergraduate and graduate students from New Brunswick universities.

Hydrocarbon Resources: The Geological Surveys Branch or more appropriately the provincial government through the Department of Education should make graduate research funding contingent upon New Brunswick based thesis topics. In fact, if UNB were to exceed an established threshold of New Brunswick related theses topics additional funding should be made available in an incremental fashion to encourage further in-province research. In other words, why should the tax payers of New Brunswick pay professors salaries and fund graduate research at our provincial university for theses topics or study areas outside New Brunswick and which only directly benefits other provinces or countries? To further emphasize this point, how many extra-provincial or international professors or geoscience graduate students are there presently carrying out research in New Brunswick?

One way to increase the percentage of New Brunswick related thesis topics at the UNB Geology Department would be to actively support professors and their graduate students interested in conducting, research on topics relevant to the New Brunswick mineral industry, and to aid them in obtaining private and public funding support for these projects. Part of the Geological Surveys Branch budget ($100,000) should be allocated to hire the students and support thesis projects.

Another issue in this regard is the amount of federal government funding which is provided to the Atlantic Geoscience Centre (AGC) at the Bedford Institute of Oceanography in Halifax. AGC is the eastern division of the GSC and as such is supposed to carry out research

studies which benefits all of Atlantic Canada. Why is it then that the overwhelming proportion of studies and funding is directed at on-land and off-shore Nova Scotia and the other three Atlantic provinces receive proportionally little benefit? This situation needs to be rectified and the benefits of AGS research work be more equitably allocated to all Atlantic provinces including New Brunswick.

- *GIS Databases:* During the last 5 years, there has been an increase in client requests for digital data. Most of the data collected in the 90's is in digital format whereas that collected prior to the 90's is not. Further, the GIS database is being populated with data that represents maps plates. Very little effort is being put into digitally collecting Geoscience Information Point (GIP) attribute data such as outcrop data, surficial geology site information. Clients are also looking for this data but needs a major effort to digitize that information.

  A number of databases were created using older programs. These programs have to be updated but again priorities. Most of the prospectors are still looking for good hard-copy maps. So, we have to compromise in order to satisfy both type of users.

- *Internet:* The Minerals & Energy Division should provide geoscience data to our clients via the Internet. Priority should be given to our maps, list of publications, assessment files and lists of all other databases and geochemical analytical files, then the mineral occurrence data. However, we should see how many people respond affirmatively to this question from the Davis survey and then additionally undertake a more in-depth survey of our own publications mailing list clients. One could spend much energies (human and financial) in setting up such a service for only a few customers. The detailed survey would not only identify the quantity of people interested in downloading data but also the various formats that people would like to see the data in and what they are willing to pay for it, if indeed, charges are a consideration.

  Regarding our current data formats, we do have a few clients that are not very comfortable with our data; they find the CARIS products cumbersome to work with. We should proceed much quicker with a revamping of the mineral occurrence database. Information Services Branch of DNRE should be approached to give the priority for this project.

  Regarding using Internet as a promotional tool, it is an excellent utility to reach our existing and potential clients; as it stands now, our site is very cost effective, but we provide only limited information. If we are to go beyond the basics, we do have to have a dynamic (not static) site and this involves having the manpower to constantly maintain and update our site, especially if we give priority to offering our clients hard data, i.e. maps.

- *Assessment Reports:* One year of confidentiality seems sufficient. One year is the required confidentiality period for well reports under the Bituminous Shale and Oil and Natural gas Acts; general reports under these acts are retained confidential until one year after termination, surrender or cancellation of the licence. However, the general reports may be released prior to the one year requirement if permission is granted by the licensee. The assessment files should be microfiched during the confidentiality period. Now it is closer to 4 or 5 years before they become available
- *Drill Core Storage Program:* We are not sure if the drill core program is an incentive for exploration, but we are sure that is an aid to anyone carrying out exploration in the province. The core storage facilities, especially Madran, are extensively utilized by exploration and mining companies. Marico utilized the Fredericton facility studying chips before they started their drilling program. If an up to date inventory of the core stored by the Minerals & Energy Division were on the web, it may help promote the program.
- *Promotion:* The current operating budget for investment promotion represents a minimal effort to reach out to potential clients. The funding provides the means to go where the industry congregates and that is at the two major Canadian mineral exploration annual meetings, PDAC (Toronto) and Cordilleran Roundup (Vancouver). We feel that by attending these conferences we are utilizing a cost-effective promotional method and being provided an excellent opportunity to network with potential clients.

  The target audience at these two aforementioned conferences is primarily the metal industry. On two occasions during the last 15 years, the Minerals & Energy Division at DNRE supported a team effort to promote our industrial mineral base at an industrial mineral conference, this was in Boston many years ago and in Fredericton-Halifax; perhaps more attention needs to be directed at promoting investment opportunities in this sector. Similarly, a major display of Hydrocarbon Resources was not taken outside of New Brunswick.

  Current funding does not provide for the development of any new promotional materials such as brochures, display materials, etc.

  Within DNRE, in particular the Minerals & Energy Division, funding associated with any promotional effort is not looked upon as strictly a business opportunity, but involves the issue of 'Out of Province' travel, how many people and how much money is it going to cost; at times it appears the objectives of the promotional effort seem to be lost in the bureaucratic world.

The investment promotional program of Minerals & Energy Division should be reviewed with respect to industrial mineral promotion. The Industrial Minerals Geologist is not comfortable promoting properties or a resource based on "potential, backed-up with very limited factual information. In addition, funds are not available to attend the venues frequented by the "movers and shakers" in the industrial minerals industry. The PDAC, and the Western Round Up have little in common with industrial mineral development in New Brunswick. Promotional efforts are far better served by meetings such as the Industrial Minerals Congress, particularly when held in North America, The Forum on the Geology of Industrial Minerals, and Industrial Minerals, an annual conference held in Canada addressing industrial mineral market developments throughout the globe. The promotional budget allowing qualified staff to travel to various venues, and present factual geotechnical and related information (i.e. transportation infrastructure, assistance programs etc.) is very small compared to other provinces and can expect minimal returns.

- The short answer for the first series of questions (on the geoscience database and appropriateness of the mix in the database) is yes. The provincial organization has been set up to ensure an appropriate mix of bedrock and surficial mapping accompanied by geochemical surveys, promotional programs, etc. The data collected in these types of surveys provides baseline information critical for other endeavors by our department and by industry. Regional geophysical and geochemical surveys are cost prohibitive for our organization. These are generally conducted by the Federal government and funded by them or some other external source. Many more of all these types of surveys are needed to accurately assess mineral potential and to guide exploration for the future.
- *Additional work:* See Mandate Review and attached table (Mandate Review table were not attached to document received by authors).
- *Mineral Deposits:* Work on these is essential for the understanding and promotion of New Brunswick's resources, and critically, for the establishment of exploration models. These studies are either based on geography (i.e. along with a given mapping program) or based on commodities/metallogenic environment (e.g. granite-related polymetallic mineralization). Both approaches are currently employed by our department and a balance is maintained between commodity-driven studies and more general mapping programs. The focus of such work is outlined in the Mandate Review and the attached table.
- *Academic Research:* Cooperative studies between our department and universities should definitely be encourage and increased, not only with UNB, but, with others as well. Ongoing,

high quality bedrock mapping and mineral deposit studies have been achieved in southern New Brunswick through cooperation with Acadia University. A similar approach utilizing field-based programs with UNB would also be very beneficial. This requires partially DNRE-funded research with active participation by professors and students.

- *Internet:* Although a few companies outside the province have requested that detailed information (e.g. assessment files) be made available via the Internet, most appear to need only basic information (i.e. what has been done and where). The high levels of funding required for digitizing and updating detailed information for Internet purposes would be better spent on baseline studies. Basic information that should be made available are as follows in order of priority: claims, historical claim coverage, Mineral Deposit File, and geological, geochemical and geophysical survey coverage.
- *Drill core storage:* Drill core storage and the facilities made available do provide incentive for mineral exploration. Access to the core for mineral deposit studies by our department is crucial, especially for mineral deposit studies by provincial and federal government geologists.
- *Promotion*: As with any business, there can never be too much advertising. The most effective medium is definitely conference displays and talks.
- *Geoscience data:* The EXTECH program was funded by ACOA. This type of program focuses a multidisciplinary team on intensive work in a given geographic area to bring a new level of understanding to its geology. In the case of N.B., the program was successful in clarifying and explaining the origins of the region. Already it has stimulated $12 million in exploration spending. The work of the past 5 years has revolutionized the detailed interpretation of the Appalachian belt, including the Bathurst camp. It has resulted in new age assignments.

  It would be ideal to extend the same sophisticated methods to the remainder of the Province, but resources are not available, either $ or people, either in N.B. or at GSC. Federal involvement in new EXTECHs depends on getting new money from Cabinet. If federal funding did become available, other provinces are in line to get an EXTECH. The N.B. EXTECH was looked on by the federal government as a demonstration project to show the value of a coordinated comprehensive approach to geoscience. It involved a number of GSC scientists and used a lot of resources.

  There should be detailed re-mapping of a province every 20 years, including stream and groundwater geochemistry. Existing data should ideally be digitized, but cost constraints are recognized.

Make more geoscience data, especially digital data, available at low cost, and in a consistent format. EXTECH produced a coordinated data base, but now the data are being sold by different agencies. Current high data acquisition costs discourage its use. Put it on the web. N.B.: assistance for upgrading data sets could be available from the federal government under a new $60 million geomatics program ($12 million/year).

- *Marketing effort:* Instead of a shotgun approach, target specific larger companies. Senior government people should visit and show their wares. Hire competent PR advice. Develop a dynamic speaker who also has geological expertise. Follow the examples of Alaska and Manitoba, which are clearly open for business.
- DNRE doesn't have any geologists charged with interpreting and reinterpreting the existing geoscience data base from the perspective of developing exploration targets. There is lots of airborne survey data available, but no one is publishing interpretations of it designed to attract the attention of mining companies and prospectors. If the government doesn't do this, few companies are likely to do so and, even then, the interpretations don't result in any investor interest as they are for in-house use.
- It should be a top priority to make full use of the Internet/world wide web for attracting exploration investment by making geoscience , including assessment and claim, data readily accessible. Commodity reports and geoscience data interpretations also should be on the world wide web.
- The geoscience database could be enhanced at lower cost than at present by going back to the approach of the 1950's and 1960's, that is, hiring students from New Brunswick universities as the entire field party for mapping programs. This would cut down on the need for as many staff geologists devoted to mapping and would lead to more graduate student theses on New Brunswick . BC and Alberta mines departments offer much more student employment than N.B..

  In New Mexico, there are cross appointments in the geological survey and the university. This results in cost savings because of shared equipment and a greater contribution by the university to developing the resource potential. N.B. should consider the possibility of cross appointments, particularly in these times of budget restraint.

  Another opportunity to create geoscience and local exploration spin-offs from more cooperation between DNRE and UNB could be to work together in filling the gap which is being created in the demise of university exploration programs. For example, the Minex program at McGill is dead and the similar program at Queen's is in jeopardy.

BC is on the leading edge of Internet access for mineral occurrence , mining claim and geoscience data. N.B. perhaps should reallocate to improving Internet accessibility of data some people that currently are on field projects and individually seeking to act as expert advisors to industry. We need to be innovative, get to the maximum number of people and avoid duplication in selling ourselves. There are new and more effective ways of looking at things.

4. Research and Development into Mineral Technologies

4.3 Metallic minerals processing

- New Brunswick must commit to jointly funding projects aimed at the metallurgical issues facing New Brunswick type fine grade ore deposits. The Department must work with the federal government and industry to improve the metallurgical technologies available which, we feel, will make a number of existing deposits in New Brunswick economic. The Government must be willing to allocate funding to research and development.

4.5.1 Control of acid drainage

- One of the major issues facing the New Brunswick mineral industry in the future will be how to address the issue of acid mine drainage from New Brunswick sulphide deposits. Treatment in perpetuity is not a long-term solution to this challenge and it is one which will become harder and harder to sell to society at large.
- We need to emphasize MEND-type projects and make it good business sense for industry to participate fully. Governments must find ways to assist industry in developing a technology which will solve the environmental challenge. As long as governments allow treatment in perpetuity, companies will not commit dollars and effort to solve the problem of acid mine drainage. The environmental community has long argued that we should phase out over a ten-year period accepting closure plans which are based on treatment in perpetuity. New Brunswick cannot move on this issue alone as it would have serious consequences on future investment in this province.

4.6.1 MMTA tax credit

- The Act incorporates provisions for stimulating further processing in the Province. For example, costs of smelting or further processing may be deducted against taxable revenues and profits. It is suggested, however, that this incentive may be more effective if the MMTA did not place limitations on ownership of the facility or on the source of the feed.

4.6.2 Value Added Mineral Processing program (VAMP)

- There is little publicity on VAMP regarding its availability.
- The rules for eligibility are not straightforward.
- The requirement for industry cost sharing should be lowered from the present 50%, or even eliminated entirely. It should be replaced by a small MESP-type grant for the embryonic testing stage, then increased progressively as it moves to a more advanced stage.
- The current practice of advancing 30% of funds at the beginning and nothing further until completion is unfair. Recipients should receive monthly advances upon rendering a statement of expenditures, as is the practice in the case of NRC IRAP grants.
- The program does little or nothing to support the market development needs of prospective industrial mineral producers.
- We find the VAMP program somewhat limited. Eligibility criteria are open to interpretation by individual officials.
- There is a need for market development support and the Department should keep a file of specific secondary products as an aid in maximizing utilization.
- The availability and composition of metal-bearing tailings should be publicized so that inventors could examine the chemistry of such materials to devise methods of treatment.
- We need to get ideas from chemists and engineers in the Province. This will necessitate rethinking opportunities and mechanisms for R&D in the Province.
- VAMP (value added mineral processing) funds have been obtained for testing a conventional process for leaching tailings and for treating mine drainage to recover metals. The maximum annual grant of $30,000 was not straightforward to obtain, but has definitely resulted in work that the company wouldn't have funded without the grant. A refundable corporate income tax credit would not have triggered the work. In any case, it probably would not have qualified.

- The government should provide small outright grants in the order of $5,000 to allow initial testing of a technical idea and its development to the point where it could be sold or where it would justify further private-sector expenditures under a cost-shared program. It is difficult for an entrepreneur to generate funds to test new ideas.

5.2 Regulation

- One company complained about an apparently arbitrary provincial decision to set the allowable discharge of one contaminant at a small fraction of the federal limit. The Company felt that the decision was not well justified on the basis of scientific evidence of need.
- Another company noted that "Mining exploration activities in New Brunswick are currently governed by a myriad of regulations interpreted and controlled by several . . . government departments (Environment, Natural Resources, Economic Development, Finance, etc.). . . . simple rules should be controlled by an unique government office."
- There is a Standing Committee on Mining and Environment. Unfortunately, it does not work very well because of difficult behaviour on the part of certain senior officials (my way or no way).
- Governments have . . . made strides in improving regulatory performance. . . .In comparing experiences across jurisdictions, Manitoba has made an impression by its tales of an approvals process characterized by timeliness and cooperation. This leaves industry with a sense of a government committed to mineral development - from the Premier through the bureaucracy. . . . in all cases the environmental assessment was completed and licenses issued in less than six months.
- We need to get to the stage in New Brunswick of streamlining the approvals process to the point that we can publicize with actual cases the time required to obtain all necessary approvals from the various departments and agencies, as is done by Manitoba. Industry supports Manitoba's claim that it can take as few as 3 months to get the necessary approvals from government.
- Legislative requirements must not impose costs or delays disproportionate to improvements in environmental quality. The [Clean Air] Act stipulates a time frame of at least six months for public review of applications for new or amended (any increase in emissions) Certificates of Approval. It allows for extension of the participation period but there are no provisions to shorten the review period when environmental impact is minimal. As well, this prescriptive

approach eliminates incentives companies may have to involve the public in development planning outside this legislation.

- In Canada, jurisdiction for the environment is shared not only between provincial government departments, but with the federal government. This has resulted in a web of overlapping, sometimes duplicative legislation. A case in point is protection of fish habitat, regulated under the federal *Fisheries Act*. Its requirements are absolute and cover a broad range of activities, many of which are also covered in provincial legislation. In New Brunswick, permits are required (Watercourse Alteration Regulation) for activities that could disrupt aquatic habitat(inland waterways). Thus, provincial regulators might approve an application, but a project can be on hold pending the results of the federal authority's review of the same activity. While the relationship between New Brunswick and federal authorities seems more cooperative than in other jurisdictions, effective administration of approvals processes should not hinge on good will between regulatory authorities.
- Large investments in mines or smelters are time-sensitive because of fluctuating metal prices. There is a short investment window to catch prices going in the right direction. Slow approval processes can destroy a project's profitability for ever.
- The amount of information needed to fulfil regulatory requirements in order to start up any phase of a mining operation is, I believe, just too much for a small or first time entrant. I think the government should allocate, say $50,000 to any junior operator so that environmental studies can be conducted in order to obtain approvals for drilling programs, trenching, bulk sampling, stream alterations, i.e. water consumption, road construction to site, etc. (This can be viewed as support for the mining industry in the same way that forestry, particularly the small woodlot owners, is supported through the tree nursery and silviculture/thinning programs).
- The regulators (health and safety, environment, natural resources) must be seen as helping the industry. All too often one hears "oh no, not another mining operation". The bureaucrats should be leading the way in showing miners how to do the job right. The hands off policy is not helping the industry or the province.
- Uncertainty and delay are inevitable . . . when different agencies must make a decision on an application for a permit. The adverse impact can be minimized by coordinating the review process – effectively adopting a 'one-window' approach.
- Government should provide a one-person contact responsible for assisting the company from A-Z in the approval process. The Standing Committee on Mining and Environment

(SCME) is a good interdepartmental forum to streamline the process but DNRE (M&E) needs a "facilitator" to help industry understand all the steps required to minimize delays.

- Environmental assessment and regulations are inefficient because two levels of government are involved. The Province should appoint a "mining advocate" (as in B.C.) and / or create a one-window approval system.
- Current legislation sometimes has perverse consequences. In order to improve on the approval process, legislation should be written to suit the actual conditions:

  a) Does a limestone operation have to follow the same requirements as a sulphide operation?

  b) Why isn't a quarry mining limestone as an aggregate not required to follow the same process as a quarry mining limestone for its chemical uses? (The definition of "mineral" does not alter the environmental impact!)

  c) Protected areas, parks, ecological reserves (proposed and real), water buffer zones, etc. should be thoroughly evaluated for their mineral potential and applicable legislation should be prepared for "allowable extraction under certain conditions".
- A very positive feature about New Brunswick is the small bureaucracy and generally good relationships with the industry. However, a more proactive Standing Committee is desirable. DNRE and DOE appear to get along well relative to other jurisdictions. The weakness is perhaps lack of leadership in the Committee.
- In the case of our best exploration targets, a requirement that all effluents be discharged outside the designated watershed poses an environmental hurdle to any mine development.
- During one exploration project, DOE officials threatened us with a $1 million fine for fording a stream with vehicles and stirring up sediment. But government vehicles had been fording the same stream beforehand.
- There is talk of public forums becoming part of the process of gaining certificates of approval. This could unduly increase the time required.
- Our mine has been issued certificates of approval for only 1 year at a time whereas another had 5-year periods of approval.
- No explanations are given when the government decision is "no". This shouldn't be the case.
- On balance, we are not finding the approvals process any easier than in other provinces.
- DOE officials make unreasonable requests to use outside consultants from time to time. For example, we were asked to bring in a consultant from the States to carry out tests. The cost would have been $200,000. The company protested and the DOE official eventually withdrew the request.

- The Standing Committee in theory is good, but, in practice, it has been plagued by small-p politics and some DOE attitudes which do not appear reflective of government policy. Terms of reference should be reviewed and perhaps modified to ensure that decisions of the committee are in line with overall government policy.

5.3 Exploration incentives

- The Province should adopt a former Quebec policy of granting up to 20% of capital investment in a new mine. A marginal deposit like Half-Mile Lake would benefit from such a policy.
- New Brunswick's exploration incentives are not competitive with those offered in other provinces.
- The New Brunswick Government should develop a "flow through" funding program to help the mining companies who are investing in the province.
- Initiation to geology courses should be given at the high school level to every student in this province. This would help to promote the prospecting activities over the entire province. The CEGEP program in Quebec requires all science students to take a mandatory geology course.
- The Province should introduce a tax credit for all taxes payable under the Metallic Mineral Tax Act (MMTA) for direct drilling expenditures for seeking new minerals or to extend the life of a producing mine. Only incremental expenditures over an established base level or multi-year average level would qualify.

5.5 Taxation and tax incentives

- Canadian mining taxation is in general more complex than that of other countries
- Within Canada, New Brunswick and Saskatchewan are the most complex because of the existence of 2-tier system: a flat royalty and a profits-based tax. The existence of a flat royalty is an anomaly within Canada.
- New Brunswick's royalty under the *Metallic Minerals Tax Act* (MMTA) penalizes low-profit metal mines. In Ontario, Quebec and B.C. modestly-profitable mines pay very little tax but taxation is more progressive with increasing profit.
- A flat royalty can also raise the cut-off grade, effectively reducing mineable reserves.

- The revenue-sensitive portion under MMTA is itself complicated by interactions with the royalty. For example, the deduction for undepreciated capital needs to be managed over time by a company in order to optimize the timing and amount of tax payments. This involves making assumptions about the future.
- As well, the overall level of taxation under MMTA is higher than most other provinces.
- The bottom line: companies seek two things in a tax system: low taxes and simplicity. New Brunswick's system is lacking on both counts. Small companies in particular find the Province's system troublesome.
- Cumulative exploration costs on a property should be returned (assuming a mine results) in the form of a refundable credit to offset capital investment. Alternatively, this amount should be recovered from profits before any tax liability begins.
- If an operating company increases its advanced exploration expenditures (eg, drilling) above an established base level (say, last 5 years' average spending) in order to locate new deposits or extend the life of an existing mine, it should receive a tax credit equal to the incremental amount spent.
- The tax regime should be examined and modified to ensure that reclamation and environmental bonds, lease costs, and other legislated costs are not a detriment to mine openings.
- A simple, straightforward, reasonable, stable, competitive and fully acceptable system of mine taxation must be in place. Tax legislation must not have a record of continual tinkering.
- The mining industry is strongly impacted by the Capital Tax because of its capital intensity. The tax has clawed back most of the savings accruing from the introduction of HST. It should be rethought, as has been done by some other Canadian jurisdictions, notably Nova Scotia.
- The royalty portion of the MMTA is levied irrespective of the profitability of an operation. The magnitude of the royalty and its insensitivity to profits means the impact is felt doubly by the operation. Some form of economic rent for resources is appropriate, but this is an area where measures may be implemented to enhance competitiveness and spur investment.
- The Province should examine its tax policy relative to other jurisdictions and set the lowest level possible: e.g., deleting royalties on all mineral deposits.

5.6 Non-profit taxes, levies and charges

- Under the guise of "rationalization", user fees imposed by all levels of government have grown exponentially in the 90s. The NBMA believes in the user pay principle. But it must be

ensured that the user is receiving value and is simply not being asked to pay another tax. Cost recovery should be imposed only after assuring that the levy is actually a fee for (necessary) service and all steps are taken to streamline the process. Thus, a clear, consistent cost recovery policy should be set, against which existing and future fees must be assessed.

- Payroll taxes and other mandated costs are "job killers". The industry is a price-taker. In order to survive increases in uncontrollable costs, therefore, the company must reduce other costs, including wages.
- There are too many up-front costs. The tax regime for natural resources should be examined and modified to ensure that reclamation and environmental bonds, lease costs and other legislated costs are not a detriment to mine openings.
- User fees and permits are getting prohibitively expensive. In 1993, the government introduced a $3,000 annual fee for each of our air and water permits. In 1998 these were increased to $13,000 each. Total environmental fees per property can reach $40,000 or more, even for a shut-down operation.
- The cost of our air quality permit has increased ten-fold in recent years.

5.7 Reclamation securities

- I doubt that developers can avoid reclamation liability. The precautionary principle is ever gaining popularity, and there is already a lot of press coverage about past messes that mines didn't clean up.
- The industry must be responsible for the reclamation of their sites and taxpayers should not be expected to pickup liabilities that are "left behind". However, expectations must be clearly established up front and industry can not be subjected to "surprises".
- Reasonable taxation provisions must exist to ensure that funding is set aside or provided for while the mine is operating. Reclamation and environment securities should be established in a form that will allow mine development to proceed but will provide assurance that funding for reclamation and ongoing environmental activities is available on mine closure.
- At some point following closure, there should be a sign off and transfer of responsibility with provision for ongoing treatment in the form of an annuity or like instrument if required.
- A negotiated cash and bond combination is probably the best or most workable approach where there is a small pool of operators, as in New Brunswick, some of which are or have the potential to be much more destructive at an early stage than others.

6. Land Access

- First and foremost, land must be available for exploration and development. Mining doesn't leave a large footprint, but the search for minerals requires access to wide expanses. The Province is following the lead of other jurisdictions in withdrawing more land from development for conservation and other land/water management objectives.
- An 'exclusive use' approach, however, yields unsatisfactory results and is ill-suited for a smaller province like ours. As well, 'bans' on mineral development over large areas is unnecessary. Regulatory processes are in place to assure environmental objectives. One of the clearest signals that could be sent to investors is to adopt a flexible, integrated 'multiple use' approach.
- In designating candidate Areas, the *Strategy* tried to avoid existing mineral claims. But conservationists have publicly stated these Areas are just the beginning and have made calls for more land to be withdrawn as 'buffer zones' and 'corridors'. Today's geoscience knowledge isn't perfect. There's no way of knowing if the areas might host a deposit that would be of tremendous value in the future. Once the areas are 'sterilized', there will be no way of knowing.
- One need only look to B.C. to see the impact of uncertainty surrounding land management and land claims. The message has been sent to investors that mining is not welcome and exploration expenditure has dropped to historic lows. The impact in a smaller province could be even more significant. The Province must adopt a flexible, integrated approach to land (and water) use management. This is more critical than all the exploration incentive programs combined.
- A key concern about the *Strategy* is that other conservation measures weren't considered in its development. Only 'lip service' was paid to utilization of a regional approach by considering areas protected in other jurisdictions. A strict protection classification was used (IUCN III or higher). Thus, it is likely the objectives could have been met by other initiatives.
- The cumulative impact of all land and water use management initiatives must be considered. More than a eighth of New Brunswick is already off limits to resource extraction. *Protected Areas* would withdraw another 2% of the landmass. Two other initiatives, however, could have an even greater impact. Proposals have been made for a *Water Classification System* and a *Watershed Protection Program* that would effectively ban mining in another 4% and 5% (respectively).

- Another worrisome factor is a river classification system which DOE is preparing and which will designate "Heritage Watersheds".

7. Other Considerations

7.3 government resources directed to the mining sector

- Generation and dissemination of baseline geological information consumes a large part of Mineral Resource Branch's budget. Thus DNRE's efforts to market our mineral resources encompass more than the $20K spent to attend conferences and develop exhibits. It should be recognized that the total "marketing" budget isn't believed to compare to investments made promoting other sectors, such as tourism.
- I feel the N.B. and federal governments are making quite a credible effort in promoting New Brunswick's mineral potential and enhancing the scientific information available. I am surprised that so much gets done on so little money!
- The Minerals Division of N.B. does not have enough budget to promote our mineral wealth.
- DNRE is not organized or staffed to promote the mineral industry. DNRE needs to become a partner with business in developing the industry and must be a strong advocate in government for the industry.
- The mineral industry now appears to occupy a back burner position behind forestry, natural gas, native issues, N.B. Power, etc.
- In DNRE, they have a budget setup where the salary budget has to reduce each year. This means that someone has to retire and leave, and not be replaced, each year. I feel it should go back to a normal budget, so it will be easier to replace people who leave.
- There a re a number of people who have been on contract for years (some over 10 years). The long-term contract people at DNRE should be put on permanent payroll. Some contract personnel may have been laid off already or will be by March 31, 2000. These people should have a job. The jobs of Mineral Deposit Manager and Mineral Deposits Geologist are becoming vacant. These jobs should be filled ASAP.
- Financial assistance from the government is certainly justified. They are there for 50% of the profits after a company took all the risks. If they want to come to the party they should bring their lunch or else stay home and don't tax.

7.9 Industrial minerals: a question of focus

- There should be good potential for industrial minerals in New Brunswick. But the problem is less in finding them than in understanding market needs and marketing the product. Devote effort to understanding the market for industrial minerals and work back from there.
- Industrial minerals should be promoted at the International Conference on Industrial Minerals.
- Market development support is a valid program. I have been a side-beneficiary of market reports prepared previously for others. Though my concepts did not lead to commercial activity, the availability of the market reviews was a big help in drawing up proposals.
- A greater proportion of programs should be outside the Bathurst camp and, when possible, they should be designed to facilitate and encourage exploration for a broad range of commodities rather than, for example, just base metals.
- In order to avoid the need for any NB budget provision, give a generous tax free period to any business established in the province as a consequence of R&D carried out in NB. As an incentive to set up R&D facilities in the province or fund R&D at existing facilities owned by other parties, persons brought to NB for conducting the R&D would be exempt from the provincial portion of income tax for 5 years from the time of entering the province.
- The VAMP programme definition should be expanded to allow market development and ASTM tests to qualify in the case of industrial minerals. Government should continue to require industry to match the expenditure.
- Individual potash deposits of economic potential are of a wide lateral extent, deeply buried, soluble in water and, compared to base metal deposits, are of low value per tonne. Competition for potash rights is relatively low and staking of claims under the same rules as for metals is inappropriate. Award potash rights on a concession basis, with a bonded exploration commitment much the same as recommended for hydrocarbons.
- The Mining Act needs to be changed to allow trial shipments of the size required to evaluate markets before doing an environmental assessment and applying for a mining lease, in the case of industrial minerals.
- The province should do market, mineral deposit studies and even prefeasibility reports on industrial mineral deposits which are considered to have development potential. These should be then used to attract investors in much the same way as the Economic Development department attracts investors for other targeted businesses such as call centres, etc.

- The VAMP program should be broadened in scope and funds made available to research markets, do processing tests and test industrial product market acceptability. Also, VAMP is poorly publicized.
- The industrial minerals side of DNRE is weak, understaffed and underfunded. (In reference to VAMP).. we should encourage to the fullest extent new ways of processing minerals, particularly to lead to significant advances in the way minerals are used. There is also a need for market development support and the department should keep a file of specific secondary products as an aid in maximizing utilization.
- The amount of information needed to fulfil regulatory requirements in order to start up any phase of a mining operation is, I believe, just too much for a small or first time entrant. I think the government should allocate, say $50,000 to any junior operator so that environmental studies can be conducted in order to obtain approvals for drilling programs, trenching, bulk sampling, stream alterations, i.e. water consumption, road construction to site, etc. (This can be viewed as support for the mining industry in the same way that forestry, particularly the small woodlot owners, is supported through the tree nursery and silviculture/thinning programs).
- Is the provincial geological program driven by the industry? What proportion of the program is self-serving? Who audits the output? How much of the program is practical geology and what amount is research? I remember the discovery of the potash deposits. Does the same zeal exist?
- Mining and geology information marketing efforts of the government are not integrated enough. An individual rather than team approach is taken. Resource processing aspects and marketing of the commodity are not given enough consideration. Not proactive enough. Industrial minerals/metals that have been ignored perhaps should be promoted or marketed, e.g. Benjamin River apatite/phosphate and Woodstock manganese (not only for the manganese but also the gallium and germanium content).
- Currently, 30% of VAMP funds are given up front and the balance when the project is complete and report submitted. This poses a hardship of small industrial mineral or other such product developers and should be replaced with a monthly billing and payment scheme as applies in the case of IRAP grants.
- VAMP perhaps should be expanded to allow for using mineral raw materials to solve environmental problems, eg. to investigate local clays for use in lining land fill sites to which each year 3-4 cells are added and lined with imported clay. The industry sharing requirement

should be dropped in the case of early stage R & D up to a limit similar to that of MESP. The "prospecting"concept applies in both cases.

- Embryonic funding that is not cost shared is needed along with support for marketing, preparation of promotional packages and travel.
- Reports should be prepared with the idea of providing resource information, market potential and prospective development economics. These should be accessible via the Internet world wide web by doing keyword searches on commonly used search engines.
- In the case of industrial minerals and structural materials, development could be facilitated by government working to better utilize existing shipping facilities and ports.
- DNRE should be more promotional, proactive and have a much more "open shop" mentality with respect to developing industrial minerals.

Appendix E: Persons Consulted

The following persons kindly made valuable information available to the authors through interviews, submissions, questionnaire responses, and personal consultations. We are very grateful for their invaluable assistance.

Interviews

John Anderle
Geologist, Fredericton

Dwight Ball & Don Gemmell
Three-D Geoconsultants Ltd., Fredericton

Al Buzas
Elmtree Resources Ltd., Bathurst

James J. Chandra, John Fudge and Jim Richard
NB Department of Economic Development and Tourism, Fredericton

Robert Conner
Prospector, Howland Ridge

Reg Cox
Prospector, Fredericton

Greg Crouse
Drill Core Manager, MESP & NBEAP Coordinator, DNRE

Dr. David Desjardins
Consulting process chemist and entrepreneur, Fredericton

Jean Desrosiers (Vice President Zinc), **Daniel Picard** (General Manager, Belledune Smelter) and **Russell Betchervaise** (Comptroller)
Noranda Inc., Bathurst

Peter Fenety
Prospector, Charlotte Resources, St. Andrews

Bill Gardiner
Geologist, Southfield resources Ltd., Sussex

Alan Graham
Consultant and former Minister of DNRE, Rexton

Alan Gregory
Entrepreneur, McMinn Pit Ltd., St. Andrews

Dr. Irwin Itzkovitch
Senior Vice President, Noranda Inc, Toronto

Rick Kowalski
Industrial Technology Advisor, IRAP (National Research Council program representative based at NB Research and Productivity Council)

Denis Lachance
Mine Manager at Heath Steele and NB Mining Association President

Dr. Dave Lentz
Geologist, DNRE and since Jan. 1,2000, Economic Geology Chair at UNB

Wayne Lockhart
Geologist, Boistown

Steve McCutcheon
District Geologist, Bathurst office, DNRE

George Murphy
Prospector, Bathurst

Ron Shaw
Mining Recorder, DNRE

Rufus Smith
Prospector, Log House Construction, Bathurst

Bob Stairs
Businessman, former owner of Stairs Laboratories, Bathurst

Dave Stevens
Prospector

Dr. Nicholas Susak
Acting Chair of UNB Geology Dept. and geochemistry professor

J. Dean Thibault
Thibault & Associates, applied process chemical engineering

Dr. Joe White
Chairman of Geology Department, UNB

Claude Willett
Prospector, Bathurst Exploration Ltd., Bathurst

Interview and completed questionnaire

Earnest Brooks
Consulting geologist, Bathurst

R. Dick Cavalero
Consultant (former Anaconda geologist at Caribou), Bathurst

Mark Connell
Geosleuths, Sussex

John Duncan
Consulting geologist, Bathurst

Raoul Gauthier General Manager, and **Jean-Guy Lirette**, Human Resources Manager NB Division, Potash Corporartion of Saskatchewan Inc. (PCS), Sussex
(Mr. Gauthier was 1998 NB Mining Association President)

Don Hattie
Geosleuths, Sackville

Ron Hawkes
Geologist and mining executive, Fredericton
(Formerly, eastern Canadian regional exploration manager for Noranda Inc)

Gustaaf Kooiman
Consulting geologist, St. George

John McCombe, General Manager of Caribou Mine Division: **Keith Whalen**, Controller, **Gaetan Noel**, Exploration Manager, Eastern Canada: **Robert Carreau**, Superintendent of Environmental Services, Caribou Mine Division; and **John Martin** CanZinco (Breakwater Resources Ltd.)

Terry Mersereau
Northeast Exploration Services, Bathurst

David Plante
Executive Director, The New Brunswick Mining Association, Moncton

Ken Whaley
Mactaquac Mining, Kingsclear

Bill Wilson
Oak Point Research Centre and W. J. Wilson & Associates Ltd., Saint John

Gary Woods
Regional Exploration Manager, Noranda Inc., Bathurst

Completed questionnaire

Bert Bourgoin
Roycefield Resources Ltd., Fredericton

Don Burton
Etruscan Enterprises Ltd., Dartmouth, NS

DNRE officials
Sussex Regional Office

DNRE officials
Bathurst Regional Office

DNRE, staff of Geological Surveys Branch
Fredericton Office

Norm Pitre
Lone Pine Exploration Services & Golden Bay Resources Ltd., Bathurst

Interview and written submission

Dr. A. B. (Ben) Baldwin
Geologist, Miramichi

George Greer
Occasional consultant and retired DNRE Chief Inspector of Mines and Director Mineral Development, Fredericton

Bill Luff
Consulting geologist, Bathurst

Garry MacEwen
Policy and Planning, DNRE, Fredericton

Dr. R. R. Potter
Consultant and former Director of Mineral Development Branch of DNRE, Bedford, NS

Michael Taylor
President of NB Prospectors Association and of Slam Exploration Ltd., Miramichi

Consultations

Louis Arsenault (re drilling statistics)
Economic Analysis Division, Metals and Minerals Sector, Natural Resources Canada

Greg Birchfield (re historical exploration expenditure and price statistics)
Statistics Division, Minerals and Metals Sector, Natural Resources Canada

Doug Brown (re international competitiveness of NB base metal mines)
Noranda Inc.

Jonathan Burt, **Peter Vanderlaan**, **Howard Pelky** and **John Bunders** (re watercourse alteration and watershed protected areas); **Joe Lejeune**, **Colleen Gorman-Lasalle** and **Fiona Bragdon** (re air and water quality certificates of approval requirements and fees)
NB Department of Environment

Don J. J. Carroll (re drill hole assessment filed and various other statistics)
DNRE

Robert Clark and **Gilles Bergevin** (re inter-jurisdictional comparisons of mining taxes)
Minerals and Metals Sector, Natural Resources Canada

Ben Dhonau (re tax and royalty provisions for mining in Ireland)
Exploration and mining Division, Department of the Marine and Natural Resources, Ireland

Dr. Michael Doggett
Director, Mineral Exploration Master's Program, Department of Geological Sciences, Queen's University, Kingston, Ontario

Dr. Murray Duke, Dr. John Wood, and **Dr. Wayne Goodfellow** (re NB mineral potential and influence of changing geoscience theories)
Geological Survey of Canada, Natural Resources Canada

Jim Gauthier-Warner (re mine show-casing program)
US Department of Interior, Washington, DC

Dr. Dale L. Hull, (re industry competitiveness, metal prices, and taxation)
Minerals and Metals Sector, Natural Resources Canada

Sam McEwan, Garry MacEwen, Rao Irrinki (re info requests, policy clarifications and consultation on the questionnaire)
DNRE, Fredericton

David Pasho and **Scott Clausen** (re inter-jurisdictional land use comparisons)
Minerals and metals Sector, Natural Resources Canada

Norman (Wally) Rayner (re land use data)
Prospectors and Developers Association of Canada, Toronto

Paul Rennick, (to obtain maps showing mineral deposits, areas with restrictions and proposed protected areas)
Data Base Manager, DNRE

Rob St-Jean (re electricity prices)
Energy Sector, Natural Resources Canada

Rejean Savoie, MLA
Chairman of Task Force on Closure of Heath Steele Mine

Shane Walsh (re energy price trends)
DNRE, Fredericton

The following persons were sent questionnaires but did not respond

Bob Baxter
PGE Resource Corporation, Rothesay

Richard Brown
Cobrun Mining Corporation, Saint John

Doug Clark
Teck Exploration Limited,, Bathurst

Craig Cooke
Phelps Dodge Corporation of Canada,, Toronto, ON

Brian Douglas
Nebex Resources Ltd.,, Calgary, AB

Tom Evans
Cimmaron Minerals Ltd., Vancouver, BC

David Graham
Celtic Minerals Ltd., Calgary

Gene Gulajec
Homestake Canada Inc., Vancouver, BC

John Hart
Consultant, Fredericton

Don Hoy
Freewest Resources Ltd., Thunder Bay, ON

Avard Hudgins
Ecum Secum Enterprises Ltd., Truro, NS

Bernard Kahlert
Major General Resources Ltd., Vancouver, BC

James E. Small
Consulting geologist, Geomercenaries, Etc., Lincolnville, ME

Dr. Peter Smith
Fancamp Resources Limited, Westmount, QC

Don Robinson
Eastmain Resources Inc., Orangeville, ON

Brad Van Den Bussche
Uranco Minerals Inc.,, Langdon, AB

Dr. John Wahl
Consulting geologist, Fredericton

Mac Watson
Goldcorp Inc., Toronto, ON

David Wood
Black Bull Resources(B.C.) Ltd.,, Vancouver, BC

Marshall Minerals Ltd., Niagara Falls, ON

Noront Resources Ltd., Toronto, ON

Pathfinder Resources Limited, Vancouver, BC